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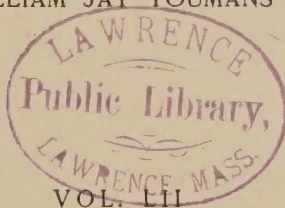


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THE END.



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PRINCIPLES OF TAXATION.

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XII.—THE EXISTING METHODS OF TAXATION.

(Continued from vol. li, page 776.)

TAXATION OF PERSONAL PROPERTY.—Great, however, as may be the inequalities in the valuation and assessment of real property, those which obtain in respect to personal are so much greater as to almost preclude the idea of comparison.

In the incipient stages of society, when property consisted almost or quite exclusively of things tangible and visible—lands, buildings, slaves, horses, cattle, ships, household effects, and implements—when railroad shares, bonds and mortgages, certificates of deposit, and all the multifarious forms of credits and evidences of debt, by which we are enabled to-day to secure interests in land or in visible, tangible personal property in the possession of others, were absolutely unknown,* and when the rate of taxation was comparatively small, the theory under consideration was not impracticable in its application, and, under most circumstances, afforded but little opportunity for the working of injustice in respect to arbitrary discriminations in assessing. For when personal property was of a visible and tangible character there was no opportunity to conceal its ownership and to avoid the tax. Each member of the community furthermore took a sufficient interest in his neighbor's affairs to see that justice was done in this regard. This kind of friendly interest found

* Of the evidences of wealth owned by one of the richest families in the United States, almost the whole did not have an existence as recently as the year 1840.

expression in Rhode Island in a law that was passed in 1673, by which it was provided that, under certain circumstances, a citizen might be required "to give in writing what proportion of estate and strength in particular, he guesseth ten of his neighbors, nameing them in particular, hath in estate and strength to his estate and strength." It is only fair to add, however, that this law was intended to prevent tax-dodging, and only required a man to guess with respect to the relative size of his neighbors' estates to his own, when he himself was suspected of having undervalued his own estate. Very curiously this ancient law and practice find expression to this day in Rhode Island in the circumstance that no citizen of that State is qualified to vote upon any proposition to impose a tax, or for authorizing the expenditure of public money, that has not paid a personal property tax *six* days preceding such day of voting. Lists of persons who are or may be qualified to vote generally are published and placarded before election, with prefixes to each name, showing the electoral qualification of its representative on the list, whether the same is dependent on real estate or personal property taxation. Any person who shall take down or destroy this list once placarded is liable to a fine of three hundred dollars, or three months' imprisonment.

Then again very little of a citizen's property was situated without the territorial jurisdiction of the taxing power, or indeed without the territorial limits of the hamlet, town, or city in which the citizen lived. Then a man could not very conveniently live in one place and do business in another. Within a century an English court has declared a contract invalid which stipulated that one of the parties thereto should do an act in London and Oxford the same day, because the stipulation involved in this particular an impossibility. Now the distance involved could be traversed in about an hour. The nature of property, as well as the means for moving it, was also such as to render all transportation difficult, and rapid transportation impossible. The discrepancy in taxation as respects different places was also so small that no great advantage could be gained by shifting one's residence or property for the sake of evading taxation; and the difficulty and inconvenience of so doing were so great that the temptation could hardly have existed. But even in the most simple condition of society the practical application of what may be properly termed the "infinitesimal" system of taxation must have been always attended with great difficulties, for the reason that it involved and necessitated personal inquisitions, than which there is nothing in government that men more dislike and resist; and, in the language of a committee of the French National Assembly of 1789 (of which Talleyrand and Laroche foucald were members), the

recognition and practice of which, by any government is something inconsistent with, and antagonistic to, the maintenance of a free people.

It is not generally known, furthermore, that Alexander Hamilton, as a member of the conventions which framed the Constitution of the United States and the first Constitution of New York, gave all his influence in favor of the restriction of all internal or local taxation to visible, tangible objects, and to the assessment of these specifically, and by some uniform and simple rule. The language used by him in one of his papers (*The Constitutionalist*) on this subject is as follows: "The genius of liberty reprobates everything arbitrary or discretionary in taxation. It exacts that every man, by a definite and general rule, should know what proportion of his property the State demands. Whatever liberty we may boast in theory, it can not exist in fact while (arbitrary) assessments continue."

Again, had nothing come down to us in English history from the time of Edward III, other than one of the assessment rolls of that period (when there was little or no property capable of taxation but what was visible and tangible), the evidence would be complete that the mass of the English people were but little better than slaves; for the mere inspection of such rolls shows that their preparation involved such an inquisitorial scrutiny into domestic life, such a seeing, handling, enumeration, and minute valuation of everything in the household, from the utensils of the kitchen to the furniture of the bedchamber, as to make personal freedom, or a sense of self-respect, on the part of the taxpayer who submitted to such a scrutiny, almost an impossibility.*

And in this connection it is instructive to again refer to the famous insurrection of English yeomen and peasants under "Wat" the Tyler, in the reign of Richard II, the successor of Edward III, which originated directly in the attempt of a tax-gatherer or assessor to ascertain, by brutal personal examination, whether a daughter of "Wat's" had attained the age of puberty, and in consequence had so become liable to enrollment for capitation assessment.

But to whatever extent simplicity in the elements of property simplified the original methods and ideas in respect to local taxation, the problem involved rapidly changed, and became more and more intricate as increasing population, and increasing commerce, and in-

* A copy of an assessment roll of the time of Edward III (1329-'67) given by Lingard, in his *History of England*, contains a list of articles, down to a towel and a bench; and the historian notes that in the returns are carefully mentioned the very rooms in which the articles were found, and that there were no exemptions except one suit of clothes for each person, which were supposed to be included in the tax levied on the poll or person.

tercommunication, required that property should, to a great extent, be put into a condition to admit of being readily mobilized, in order to allow of its most profitable use and application. Thus a large part, in fact the larger part of what is to-day termed "personal property" in every civilized state, is of the most intangible character, and in great part invisible and incorporeal: such, for example, as negotiable instruments in the form of bills of exchange, state, municipal, and corporate bonds, and the multiplied forms of evidence of indebtedness, certificates of stocks, copyrights, patents, legal-tender notes, etc., all of which, if entitled to the name of property, is, through a great variety of circumstances, constantly exposed to fluctuations in value, frightful in amount, and incalculable in their suddenness, and under the influence of which wealth vanishes as if by the wave of a magician's wand. It is offset or measured by indebtedness which may never be the same one hour with another; is easy of transfer, and, as essential to using, is in fact continually transferred from one locality to another, and from the jurisdiction of one state to the jurisdiction and laws of another and a different state; is here to-day, gone to-morrow; is burned, sunk at sea, lost in mines, patents, railways, factories, trading associations, and in a thousand other different ways. It has been recently said that five men who do business in Boston can together control or dispose of an amount of property which equals one fifteenth of the entire assessed valuation of that city; and that they could, if they pleased, carry round the evidence of the existence of that property in their coat pockets, or, according to popular theory, the property itself.

For the purpose of ascertaining the amount of taxable personal property owned by individual citizens two methods have been employed in the United States:

1. In several States, such as Massachusetts, Connecticut, and Illinois, the taxpayer is required to give each year to the assessor a detailed and verified statement, carefully itemized, of all the personal property owned by him or under his control and of every kind, sort, and description. This method is generally known as "the listing system." In several of the States the principle that a State can only tax that which is within its territorial jurisdiction is ignored, and even visible tangible property situated outside of the taxing State is required to be returned for the purpose of taxation.

2. The other and more general method of ascertaining taxable personal estate is that which is exemplified in the State of New York, by which the assessor guesses at the personal property of the victim, and places him upon the list at such a figure as either his information

or imagination sustains him in considering to be that which justly represents the personal estate of the taxpayer.*

In view of the fact (made certain by all experience) that very few returns of personal property, even when supported by oaths, are worthy of implicit credence, the position of the assessor who honestly desires to enforce the law is one of great difficulty and embarrassment. For, in the absence of some superhuman power which will permit that to be seen which to ordinary vision is invisible, and to know what, through the exercise of ordinary reason, can not be known, any attempt on his part to obtain independent cognizance of such commercial and financial instrumentalities for the purpose of valuation and assessment is, on its face, an impossibility; and if the co-operation of the person to be assessed is to be invited or relied on, two of the most powerful influences that can control human action—love of gain, or the unwillingness to part with property, and the desire to avoid publicity in respect to one's private affairs—immediately unite to oppose and prevent such co-operation.

A resort to personal inquisition, with the accompanying machinery of oaths, "dooming," and penalties, is next in order; under which the State, ignoring all rules enacted for the protection of debtors in the ordinary collection of debts, pursues the citizen for the collection of what it claims to be a debt, with no better result, in nine cases out of ten, than the impairment of the public sense of both justice and morality.

But it is claimed that each individual owes the State annually a certain sum of money in the way of taxes, proportioned to his entire property. If he voluntarily pays, he escapes arbitrary measures. If he declines to pay, or tries to avoid payment, he has no just cause to complain if he is regarded in the light of a criminal, or if the same arbitrary measures are used to collect his tax as if it were a debt owing by one citizen to another. Let us examine this averment.

If the defaulting taxpayer is to be regarded as a criminal, and

* "In a case involving the assessment of personal property, in one of the courts of this State a few years ago, an assessor in one of our cities testified that his method of ascertaining what personal property a taxpayer owned was to examine the directories, the county clerk's office, and papers relative to estates of deceased persons; and when he lacked definite information, to guess at the assessment from the place of business or of residence occupied by the taxpayer. If the tax was cheerfully paid for two or three years, the personal assessment would then be 'marked up.' This process of increasing the personal assessment went on until, as the witness graphically said, the taxpayer 'squealed,' when the amount was finally fixed at what the taxpayer would bear without swearing it off."—*Address on the Taxation of Personal Property, by Julien T. Davies, before the Manhattan Single Tax Club, January, 1891, New York.*

as such placed in the worst possible light, he certainly ought not to be deprived of the privileges of a criminal, which are a right to a public investigation according to the rules of evidence adopted by free and enlightened communities, a right to be heard before condemnation, and the right to be presumed innocent of having property subject to taxation until the fact is ascertained otherwise by legal proof. But under the existing tax laws of most of the United States there are not accorded to the taxpayer the privileges of a criminal; for no tax can be assessed on a large proportion of the personal property of the State according to any rules of legal evidence that any common law court would adopt. No assessor, under the laws of New York, for example, in assessing personal property, can act judicially. The law gives him no power to obtain legal testimony of a character that is admissible in court; he must act the part of an arbitrary despot against an inculpated taxpayer, or not act at all, and his conclusions for acting must be reached at best by the testimony of those who have no means of knowing anything, in a legal sense, about the subject-matter under investigation. It seems clear, therefore, that any attempt to tax without legal evidence is an act of usurpation or despotism, wholly antagonistic to the principles of a free government, and that it is a mockery to characterize such acts as, in any sense, judicial proceedings. Nor does the right to reduce or regulate the assessment by the oath of the taxpayer relieve the law, in any degree, of its unequal and despotic character; for every individual holding public office knows that oaths, as a guarantee of truth, in respect to official statements, have ceased to be of any value. The assessments made according to the oaths of parties, furthermore, are not made according to legal evidence, upon examination and proofs; but according to the will and secret caprice of each taxpayer, instigated by his selfishness and the natural depravity of human nature. Each taxpayer, under the present rule, becomes, therefore, the interpreter not only of the law but of the fact, and makes a secret interpretation of both, and we have as many interpreters of the law as there are numbers of taxpayers; and also an indefinite multiplicity of assessors; for each person who unfairly reduces his own assessment arbitrarily assesses thereby some other of the community for the difference. Could or would any people apply the same rules for the collection of debts? Is there any one who has so much confidence in human nature that he will propose a law that a person who is sued shall be discharged from all claims of indebtedness if he will make oath, interpreting both the law and the fact himself, that he owes the claimant nothing? Is it believed that under tariff laws the government could get sufficient revenue to pay for its collection if the importer was

permitted to offset debts against the value of his goods; or if the law was peremptory that his oath alone should be given, and that there should be no legal examination, inspection, or proof of the value or character of the importations?

In whatever aspect, therefore, we regard the present popular system of local taxation in the United States, it is arbitrary and in violation of the principles of constitutional government. If the assessor acts, he acts solely by his despotic will, and without any reference to legal proof or evidence, such as is enforced in recovering private debts; and if the taxpayer, by his oath, becomes the arbiter, his will is supreme and not subject to investigation or control. It is a system, in short, that violates all the laws of evidence, the growth of centuries in civilized countries; that makes secret that which should have publicity, and proceeds upon a basis that could not be recognized for one moment in the collection of debts, or in the trial of persons accused of the most heinous of offenses.

Such, then, are the difficulties which all experience has shown to be attendant upon every attempt to tax personal property of an intangible and invisible character, and which all who have investigated the subject acknowledge to be insuperable. As not a few, however, who are ready to make this acknowledgment nevertheless insist, that all personal property that is visible and tangible and can not be concealed, but can be reached effectively and equally, ought to be taxed; and as the drift of popular sentiment in the United States at the present time favors this assumption, it is important to next consider the nature and extent of the results attainable by intelligent and faithful assessors acting in conformity with it.

As the experience, however, of the States that have enacted the most precise and stringent methods of taxation proves beyond question, that the returns of the owners of visible, tangible personal property, even when supported by oaths, will not, as a rule, afford a basis for the correct valuation and assessment of such property, the further assumption is warranted, that the attainment of such a result in even an approximate degree must depend on the personal visitation and inspection of the most intelligent and honest assessors. And here at the very outset of the prospective investigation its inherent insuperable difficulties begin to manifest themselves.

Thus a large proportion of the so-called personal property of every highly civilized country which is *not* intangible and invisible, and which requires only ordinary perception for recognition and valuation, is in the nature of instruments or subjects of commerce between states and nations; such as railroad machinery, ships, steamboats, immense stocks of raw and manufactured products accumulated in store for the sole purpose of movement, or actually *in*

transitu. As a matter of fact the granaries for no small portion of the surplus stock of the world's cereals are at the present time ships and railroad cars in the process of movement to the points of greatest demand for consumption. What shall be the *situs* of all such things for assessment? If actual location is to be determinative, then a product of grain, or merchandise, which, in movement for a market, or conversion into other forms, may happen to be in Illinois in April, in Ohio or Massachusetts in May, in New York in July, in New Jersey in August, and in Connecticut in October, will be liable to five separate taxes in one and the same year; for the laws of each of these States require their assessors to return, for taxation, all such property as at the periods mentioned may be actually within the sovereignty and jurisdiction of the taxing authority.

If, therefore, the existing system of taxing visible and tangible personal property in the United States is to be continued and made equitable and effective, the first essential step for the purpose of making it such, by preventing evasions and avoiding duplicate taxation on one and the same persons and property, is for all the States to agree that all their assessors shall make their visitations, inspections, and appraisements for the purpose of assessment on one and the same day, as, for example, the first day of April. The following probable forecast of the result has been made by a recent writer:

"On the appointed day, all over the country, a swarm of assessors must besiege the factories, mills, shops, and stores for the purpose of making an honest valuation of all merchandise on hand. This valuation must be completed in one day; or otherwise Smith's valuation being completed on April 1st, while Jones is left to April 2d, there will be a midnight exodus of easily portable goods from Jones to Smith, so that one assessor shall find little of value in the possession of Jones on April 2d. No help must be asked in the work of valuation from the owners or clerks; for if that is done, the assessor might just as well accept the sworn returns of the owners, as is done now, with the most ludicrous and inequitable results. As it is evident also that it would be impossible for the owners themselves to make such a valuation in one day, even with the aid of all their clerks, there must be a number of assessors employed, exceeding all the number of persons employed in holding and selling merchandise. The work might, however, by extreme diligence be done in a rough way by two million local assessors. As it would take them at least three days to tabulate, copy, and file their returns, besides the one day occupied in valuing, each would serve at least for four days; and if paid at the rate necessary to procure men competent for the task, the lowest cost of such an assessment, independent of printing

and stationery, could not be properly estimated at less than forty million dollars.

"Again, on 'assessment day,' there would be universal concealment of all articles of small bulk and great value. Watches, jewels, gold, money of all kinds, and every like conceivable thing would vanish from sight. Men would walk about stuffed with valuables. Old stoves, pots, and pans would be filled with money and jewels. Valuable goods which could not be hidden would be covered with dust or otherwise made to look almost worthless. In every mill and factory manufactures would be kept in an unfinished state, as far as possible, until assessment day had passed. A thousand devices would be resorted to in order to reduce the apparent value of the things which the assessor would inspect, or to prevent him from seeing them at all.

"In order to make this plan of official valuations successful, the assessors must enter every room in every house and strip naked every man and woman whom they suspect of concealing taxable property. This is the only way in which visible, tangible personal property ever was or ever can be fairly, equally, and effectually taxed.

"And, when all this was done, the system would none the less fail. It could not be made even approximately correct. Every article would be valued very much too high or very much too low. Nor would the average produce any fair result. The goods of Jones would be appraised at two hundred per cent of their real value; the goods of Smith at ninety per cent; and the goods of Brown at fifty per cent. Jones would thus be cheated heavily, and of Smith moderately, for the sole benefit of Brown." *

On the other hand, if the fiction of law, that personal property follows the owner, is to govern, then all such property may be taxed *where it is not*, and be exempt from taxation in the place *where it actually is*, and where it shares in the benefits that flow from the protective expenditures—police, fire department, etc.—which are incident and necessary to the locality. Or, as is very often and perhaps most usually the case, the same property is subjected to double taxation; and as a proof that this latter supposition, which seems on its face an absurdity, is a matter of constant experience, it may be mentioned that some years since, and probably at the present time, a well-known publishing house was regularly taxed in Cambridge, Mass., for so much of its stock in trade as was kept in store and permanently employed in business in New York city, although it was admitted that the same tangible, visible property

* Taxation of Personal Property, Impracticable, Unequal, and Unjust. By Thomas S. Shearman. New York, 1895.

was at the same time regularly taxed by the New York authorities; and, furthermore, when a protest was made to the Massachusetts authorities against the continuance of this injustice, the decision was rendered, that under existing Massachusetts statutes the plundered taxpayer could have no remedy except by change of business or change of (State) residence.

Again, if a foreign banker subscribes to any of the State or municipal loans of the United States, the bonds or other evidences of indebtedness which he receives in exchange for his money are exempt from taxation by reason of his nonresidence; but if a *resident* widow or maimed soldier be moved by the desire for security to purchase a little of the same loan, the small rate of interest which such investments generally carry will be made still smaller to all such persons, by reason of an annual tax of from one to two or a greater percentage imposed on the holders, for the simple reason that they are residents; although the protection afforded to the latter is in no degree different from or greater than that afforded to their more fortunate and rival foreign competitors, who reside where such taxes are not imposed; all of which is equivalent to saying officially that whenever an American loan, particularly desirable for trust investments, is created, it shall be sacredly reserved for foreigners, or that bad portion of citizens of the United States who have no scruples about cheating the assessors. Local subscriptions to local indebtedness, with the augmentation of interest in the locality which would necessarily follow, are therefore discouraged; while to the American citizen who ventures to subscribe, residence is made an offense and coupled with a penalty.

In the case of agriculturists, who constitute more than half the population of the country who follow gainful occupations, their personal property, consisting mainly of farm animals, implements, and farm products, is always readily open for inspection, and has a nearly uniform value throughout the country. The personal property of farmers is accordingly more completely reached and more accurately valued by honest assessors, than the property of any other class of the population.

Consider next the case of merchants. "What assessor, however honest and competent, can personally value all the stock of even one store, not to say the stock of all the stores in his district? Fancy an assessor making a personal appraisal of the stock of fifty drug stores, a hundred dry-goods stores, and as many groceries! In one store there are hundreds of different articles at different prices, by the yard, or the pound, or the gallon. Bales of goods lie side by side; some worth four cents a yard, some ten cents, some two dollars. The difference between goods worth one dollar a yard and those worth

two dollars is often imperceptible to the eye of any one but an expert. But how can an assessor have time even to open all these bales, to look at them, much less judge accurately of their value? All the assessors of New York city could not approximately value the stock of one of its great dry-goods merchants without relying upon the word of their clerks. Therefore the stock of merchants and manufacturers would be assessed upon the valuation given by themselves, as in fact it is now. Thus the assessment of 'visible and tangible property,' in these important cases, is made and must be made in exactly the same manner as the assessment of bonds, notes, and other *invisible* property, resulting in a double or treble burden upon the simple and truthful as compared with their unscrupulous neighbors."

And, finally, as regards so much of other "personal property" as is tangible and visible, and clearly within the territorial jurisdiction of the taxing power, such as articles of personal adornment, clothing, furniture, works of art, musical instruments, books, etc., shall we assume that we have here a class of articles on which it is desirable to levy taxes? Of course, the popular answer will be in the affirmative; for are not all these objects, it may be asked, the very ones best fitted to sustain taxation? and are they not in great part luxuries rather than necessities? But how, it may be asked, are you going to tax them? for it is reasonable to suppose that if they are to be taxed, it is to be by a system that works equitably, and not by a system which, by taxing A, and letting B, C, and D escape, brings the law into contempt; and, by making the sense of the commission of a wrong on the part of the State the excuse for the commission of another wrong on the part of the individual, gradually undermines the morality of a community that does not wish to be dishonest.

An even approximately correct valuation of the above-enumerated articles is, however, a matter of great difficulty, and none but an expert can effect it. In very many houses there are many articles, like bedding, carpets, pictures, glass, porcelain, and the like, which exhibit few outward indications of undue value, and yet whose cost was very many times greater than similar articles in ordinary use. In fact, in proportion to the wealth of the taxpayer would be the failure of the most honest assessor to estimate the true value of his property. Some years ago a State tax commission in Illinois, with a view of aiding assessors to discover and rightly assess property of the character under consideration, recommended to the State Legislature the enactment of a statute whereby every woman of "full age and sound mind," either directly or by her representative, should annually return to the assessors a statement of the value of all the jewelry, household furniture, and all other property in her possession; but these recommendations never re-

ceived any higher consideration from the public than that of being denounced and laughed at. And most naturally; for what woman would tell her age or the amount and value of her jewelry and finery, and more especially to a stranger invested with brief official authority as an inquisitor and assessor?

Again, a very large part of what is termed "personal property" is, through the necessities, policy, or organization of governments, made exempt from taxation; as, for example, all instrumentalities and property of a government—national, State, or municipal—especially the bonds, notes, currency, and certificates of indebtedness issued by the United States. The several States also generally exempt or lightly tax the deposits and surplus of savings banks, the accumulations of mutual insurance companies, the property of charitable, religious, or educational organizations, and also a comparatively small amount—but large in the aggregate—of personal property in the form of household furniture, clothing, working tools, vehicles, and animals, and the produce of farms not sold but consumed by the producers; and that the present tendency of State legislation is furthermore to continually enlarge the list of exempt property. The aggregate money value of such exemptions can not be accurately stated, but there is reason to believe that they include about one fifth of all the personal property of the United States.*

TAXATION OF THE INSTRUMENTALITIES OF COMMERCE.—Extensive as has been the foregoing review of the inherent difficulties attendant on the attempt to equitably and efficiently tax personal property, the results of taxing the instrumentalities or objects of commerce are especially worthy of additional notice in this connection.

A little reflection ought to abundantly satisfy that to tax the instrumentalities or objects of commerce in one locality, and to exempt the same from all direct taxation in another, will clearly not permit the former to enter a common market on an equal basis for competition with the latter. And yet this unjust discrimination is exactly what does result from the attempt of a majority of the States of the Federal Union to tax all such instrumentalities or

* The New Jersey State Board of Taxation, in their annual report for 1895, call attention to the fact that, out of the total amount of assessed property in that State in 1894, nearly ten per cent, or \$72,786,571, was exempt from taxation. The amount of tax exemptions in Newark, N. J. (a city which within recent years has been nearly bankrupt by excessive indebtedness and taxation), is reported for 1897 at \$18,076,568, made up in part as follows: Churches, \$4,081,750; private schools, \$196,900; city property, \$4,924,950; cemeteries, \$893,800; charitable institutions, \$1,231,700; public parks, \$4,654,867. Soldiers' and sailors' widows have exemption to the amount of \$523,675; firemen, \$79,445; the National Guard, \$36,475. These figures do not include the railroad exemptions, which are under the charge of the State Tax Commissioners.

objects under the general head of personal property, and the exemption of the same classes of property from any corresponding assessment in the British provinces of North America, and in all foreign countries with which the United States enter into extensive commercial intercourse and competition. Boards of trade and commercial conventions may pass "deploring" resolutions concerning the decay of American commerce, and committees of Congress may continue to investigate the same subject, but so long as ships, engaged in the carrying trade on the *free ocean*, and owned in Canada, England, France, Germany, and Holland, are not directly taxed, and ships engaged in competition in the same business, and owned in Portland, Boston, Baltimore, New Orleans, and San Francisco, are taxed, and taxed heavily, commerce will incline to move in the paths which are made easy and profitable to it. The difference in cost of a single penny per bushel in laying down grain at Liverpool may alone be determinative of the question whether millions of bushels shall be supplied by the wheat fields of the United States or those of Russia, India, or Hungary.

"As a rule, the States of the Federal Union tax shipping as other property is taxed, regardless of the fact that the other leading maritime nations usually impose no taxes on shipping as property, but tax only the actual earning of shipping; assuming doubtless, and correctly, that from the very nature of its use shipping can not fairly share in the benefits which accrue from state and municipal taxation for public purposes. In short, when a vessel is fulfilling the function for which it is built, it is navigating the ocean, remote, except during brief stay in port, from the fields and purposes to which state and local taxes are applied."

Only one State—Delaware—exempts shipping from all taxation; New York and Alabama exempt so much of their shipping as is engaged in foreign trade; Massachusetts, New Hampshire, and Connecticut tax the earnings only of their shipping in foreign trade; and, under decision of the United States Supreme Court, Pennsylvania imposes no tax on its shipping in interstate or foreign trade.

All the other States tax all classes of vessels as personal property, making no distinction between those engaged in foreign and domestic trade.

The comparative burden of taxation on shipping in the United States and the maritime states of Europe finds practical illustration in the following examples: The city of Portland, Maine, levied more taxes in the year 1893 on its shipping (63,206 tons, valued at \$909,000) than the Cunard Company paid to Great Britain in the same year on a valuation of their ships of nearly \$9,000,000. The taxation of shipping at Charleston, S. C., is five times heavier than that

levied by Great Britain or Germany. During the year 1893 the city of San Francisco levied taxes to the amount of \$85,675 on its shipping, a sum within \$600 of the combined taxes paid during the same year by the Cunard Line, the Hamburg-American Line, the North German Lloyd, and the Compagnie Générale Transatlantique of France to their respective Governments; their combined shipping comprising upward of 700,000 tons of the best steel and iron steamships valued at upward of \$58,000,000. And in addition to this onerous and (in comparison with other countries) discriminating burden of taxation or shipping, the income-tax act of 1894 imposed an additional and new tax of two per cent on the earnings of shipping in excess of \$4,000, which would have fallen mainly on that portion of the United States merchant marine—i. e., the great American steamships—which is most exposed to foreign competition, and which it is regarded as especially desirable to nationally foster.

On the other hand, Great Britain, Germany, France, and the Netherlands tax only the earnings of shipping—i. e., an income tax. Austria in 1894 suspended for five years all taxation of its vessels engaged in foreign trade. Under this system of vessel taxation by the great maritime countries of Europe it is, furthermore, to be noted that the ownership of a ship that is idle and not earning does not entail any burden of taxation; but in the United States it makes no difference whether a ship be at work or idle, profitably or unprofitably employed, she pays taxes all the same.

The experience of the several States in respect to the taxation of vessels affords, however, a very striking illustration of the facility with which obnoxious taxes are evaded in the United States, or shifted upon those who are less able to bear them, and is thus related in the Report of the United States Commissioner of Navigation for 1894: "It is relatively an easy matter for the owner of several vessels to form a partnership with the resident of another State in which low taxes are imposed on shipping, and by allowing the vessels to stand in the name of such partner to escape the endeavor of the law to tax him more than his competitors in navigation are taxed. Thus, some years since, the authorities in Chicago decided to tax the shipping owned at that port on its full insurable value at the rate fixed for municipal taxes. The vessel owners of the city, in self-defense and to enable them to continue in business against competing ports, were compelled to make nominal transfers of their property, and thousands of tons of shipping, doubtless owned in Chicago, appear on the records of the National Bureau of Navigation as owned in other States. Though in the number and tonnage of its entries and clearances Chicago ranks with the greatest ports

of the maritime world, yet its apparent rank as a ship-owning port is insignificant."

It is important also to notice how changes in the methods of doing business, in the facilities for transporting persons and property, and in the constitution of society and standards of morality, antagonize and nullify the popular ideas concerning taxation of personal property.

Formerly (as has been already pointed out) a man could not conveniently live in one place and carry on business in another. But now men may live and be taxed at places where the taxes are light and do business every day in a city twenty, thirty, or fifty miles distant where taxes are high, and there be exempt from all taxation. And yet how are you going to prevent a citizen from deciding for himself where he will live and where, under the accepted fiction of law that personal property follows the owner, his personal property shall be taxed? Formerly, to bargain for the sale of goods in a place not farther removed than New York is from Boston or Philadelphia, transport them there, and receive the proceeds of the sale, was an affair of weeks. Now a man living in Boston may bargain for a sale of thousands of dollars worth of goods in New York, transport them there, and receive his pay in the space of a single day. Nay, more. A man may acquire property and part with it at places on the opposite side of the globe with the greatest ease and security within the space of a few hours.

A change in the standards of morality has been alluded to as antagonizing methods of taxation. Thus, not very many years ago, every man knew, at least approximately, the amount and kind of property of all his neighbors, and knew that his neighbors knew the same in respect to himself. "He was willing to admit, under oath or otherwise, what everybody knew; and he would hardly dare to drive six cows to pasture every morning and swear in the afternoon that he had none." But now let us see from an indisputable experience of very recent date how the conditions of property and of morals have changed. Previous to January 1, 1889, the State of Connecticut, in accordance with common practice, taxed personal property in the form of bonds and notes from one to two or more per cent, wherever it could be found. The result was that the State from the outset could never reach for assessment but a small fraction of such property, although every citizen was required to annually submit a list to the assessors and make oath that he had included in it all property of the character in question; and this fraction, furthermore, tended to rapidly decrease. Thus, in the so-called grand list or aggregate valuation of the State for the year 1855, the value of the notes, bonds, and money at interest made subject to assessment constituted about ten per cent of

the entire taxable property of the State. In 1865 it was about seven and one half per cent; in 1875 a little over five per cent, and in 1885 about three and three quarters per cent; and yet during the period covered by these statistics it is probable that the amount of State, railroad, municipal, and farm-mortgage bonds owned by the citizens of Connecticut increased to an extent equal to at least one half the valuation of all the other property in the State returned and made subject to taxation. In 1855 the inhabitants of eighty-one towns of the State did not own a single mortgage bond. Not a bond was returned as owned in the rich city of Meriden. The twenty thousand inhabitants of the thriving city of Waterbury by their united efforts managed to scrape together only seven hundred and fifty dollars in bonds. So far as cash is concerned, there was never a community since mankind emerged from a state of barter that got along with so little. In 1889, however, the Legislature of Connecticut modified her former statutes, and provided that the owners of all notes and bonds who would register them with the State Treasurer, and agree to pay in advance a tax of one fifth of one per cent per annum for a period of five years, should be exempted from all further State or local taxation on the same. Note now the results. The law in question went into operation on the 1st of August, 1889, and between that date and the 1st of January succeeding, something over \$30,000,000 of bonds and notes were registered under the modified assessment,* of which the treasurer in his report to the Legislature says, "Probably at least three fourths have never paid any taxes whatsoever." Here, then, within five months was uncovered to the taxing power a quantity of what the law makes property in excess of \$22,000,000, and returns are still being received in large volume. The conclusion, therefore, seems to be that there is a good deal of conscience in the highly moral State of Connecticut which can be induced to cheat and forswear on a two-per-cent tax, that can not be bribed on a tax of one fifth of one per cent; or that a tax of from one to two per cent on bonds and notes in Connecticut is sufficient to nearly tax out of existence all conscientious scruples of its people in respect to the violation of law and the perpetration of fraud in respect to matters of taxation.†

* For succeeding years the amounts registered with the State Treasurer were returned as follows: 1890, \$33,654,335; 1891, \$24,792,509; 1892, \$39,473,988; 1893, \$12,418,673; 1894, \$20,507,396; 1895, \$18,533,543; 1896, \$21,159,161. Why the large difference in the receipts of the above years occurred has not been satisfactorily accounted for by the State officials.

† In 1897 the Legislature of Connecticut, not satisfied with the unexpected large amount of notes and bonds returned for taxation at the rate of one fifth of one per centum per annum when voluntarily paid in advance, doubled the rate of tax to two fifths

In view of these facts the following answer, made some years ago by a man of New England birth and education, but of unenviable character and influence, to a question as to his father's honesty, has no little of point and application: "He is honest as the world goes. He won't tell a lie for twelve and a half cents" (the New England ninepence), "but he will tell eight for a dollar."

SEMON'S SCIENTIFIC RESEARCHES IN AUSTRALIA.

BY PROF. E. P. EVANS.

SOME years ago Dr. Paul von Ritter gave to the University of Jena a considerable fund for the endowment of research in the direction of the doctrine of evolution, and more especially for promoting the scientific exploration of Australia. The complete geographical or physical isolation of this vast island since the Tertiary period has prevented it from keeping pace with other portions of the globe in the development of animal life, and it has therefore been very aptly termed "the land of living fossils and of missing links," on account of the peculiarly primitive character of its fauna. It is evident that the oöticoids or semi-oviparous mammals, whose young are born as embryos and then hatched in the mother's pouch, would be at an immense disadvantage with the viviparous mammals in the struggle for existence. For this reason the marsupials and monotremes have been gradually supplanted by the more highly organized placentals wherever they have encountered each other in vital competition. The study of fossils shows very clearly how this process went on from age to age until it resulted in



OLD TOM.

of one per cent, or four mills on the dollar. What will be the result of this fiscal policy is yet to be determined; but it is to be regretted that the original experiment could not have been longer continued.

the Miocene period in the complete supremacy of the placentals and the almost utter extinction of the marsupials in the principal regions of the earth. Of the latter class of animals, the didelphys of the western hemisphere, of which the American opossum is the best-known species, is the sole survival outside of Australia. This is owing to the fact that all the other continents have been more or less closely connected by land during long geological epochs. This is still the case with Europe, Asia, and Africa; even the dividing basin of the Mediterranean is of relatively recent origin, as may be clearly shown by a comparison of the fauna of its northern and southern shores. Also the extreme northern points of America and Asia, although previously separated, were subsequently united for a long time, beginning with the latter half of the Tertiary period and extending into the Pleistocene age, when the species of mammals now prevailing in both hemispheres were already existent. It is therefore perfectly intelligible that, under these circumstances, Australia and the adjacent groups of islands should be of special interest to the naturalist as fields of investigation; for there he can study living specimens of mammals, birds, fishes, and reptiles of which he finds elsewhere only the petrified remains.

It was with this object in view and with the pecuniary aid derived from the Ritter endowment fund that Dr. Richard Semon, a former pupil of Ernst Haeckel, and now professor of anatomy and zoölogy in the University of Jena, landed at Adelaide in the midsummer of 1891, and pitched his camp in the Burnett district of the Australian bush, at first on the banks of the Boyne River. He engaged as companion and general conductor of the expedition a German immigrant named Dahlke, whose family had left their fatherland when he was only four years old, and who had grown up into a thorough Australian. This man furnished a dray and five horses as the most convenient means of conveyance, and secured the services of eight families of aborigines, consisting in all of about thirty persons, men, women, and children, whose business it was to catch fish and search the dense Australian scrub for specimens of its fauna.

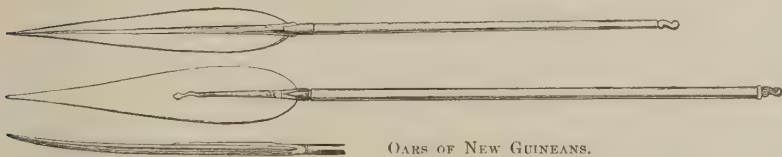
In order to stimulate the activity of the natives, Semon offered prizes for the capture of particularly desirable animals, and also promised to pay their regular wages at the end of every week; but a single experience of the results attending the latter part of this arrangement sufficed to prove its utter impracticability; for no sooner did they find themselves with cash in hand on Saturday evening than they procured several bottles of rum from a liquor shop kept by an Irish woman several miles distant, and on Sunday morning were all dead drunk. In order to prevent a repetition of this booz-

to every effort to educate and civilize them. Several of these natives soon returned, and among them "Old Jimmy," whom he learned to esteem as "the best and most faithful of assistants"; he afterward had many other Australian and Papuan aborigines in his service, and, through daily intercourse with them, became thoroughly acquainted with their habits of life, racial peculiarities, tribal organization, religious ideas, and superstitions.

After carrying on his explorations with remarkable success for nearly a year and a half in Australia, New Guinea, and the Moluccas, Professor Semon returned home *via* Java and India in the spring of 1893. The strictly scientific results of his researches during this period are now being published with the aid of several collaborators in a serial work entitled *Zoologische Forschungsreisen in Australien und dem Malayischen Archipel* (Jena: Gustav Fischer), and to be completed in some twenty-six numbers, of which six have already appeared. Meanwhile, he has given to the public a more comprehensive and popular record of his experiences and observations in a single volume, containing a mass of most interesting facts and reflections, and written in an exceedingly lucid and lively style (*Im australischen Busch und an den Küsten des Korallenmeeres*. Mit 85 Abbildungen und 4 Karten. Leipzig: Engelmann, 1896. Pp. xvi, 569. Price, 15 marks). We may add that the collection



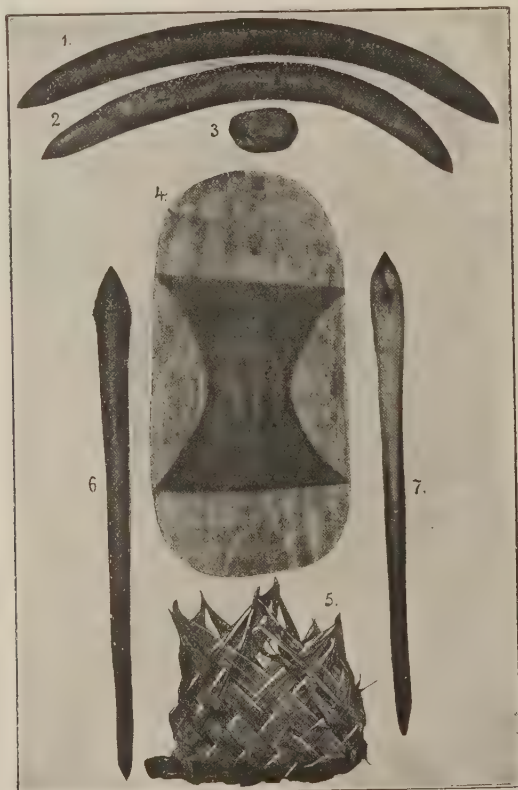
MACKENZIE.



OARS OF NEW GUINEANS.

of specimens made by Professor Semon is so extensive and extremely characteristic as to render the Zoölogical Museum in Jena the very best place in the world for studying the natural history of the regions he explored. Indeed, it is so unique that not long since an Australian zoölogist came to the picturesque university town on the Saale for the purpose of examining one of the fauna of his native land.

In the present paper we shall not attempt to follow the author step by step in all his wanderings, nor to give even a *résumé* of his zoölogical studies. The reader will find in his book reliable and very readable accounts of the phascolarctos, the duckbill, the porcupine ant-eater, the bandicoot, the dasyure, the wombat, the various kinds of kangaroos and other marsupials, the bower bird, the bird of paradise, the cockatoo, the hornbill, and similar species remarkable for



AUSTRALIAN WEAPONS AND UTENSILS. 1 and 2, boomerangs; 3, stone hatchet; 4, wooden shield; 5, reed basket; 6 and 7, wooden clubs. (1-4, 6, 7, from Burnett; 5, from Cooktown.)

their strange forms and gorgeous feathers, and the multitude of gigantic lizards, death adders, and other venomous reptiles, and the huge but harmless python known as the carpet snake. There are also vivid descriptions of the natural scenery, as well as of the natural history of this marvelous land, in which the mammals lay eggs, the cuckoos resemble pheasants, the hoot of the owl sounds

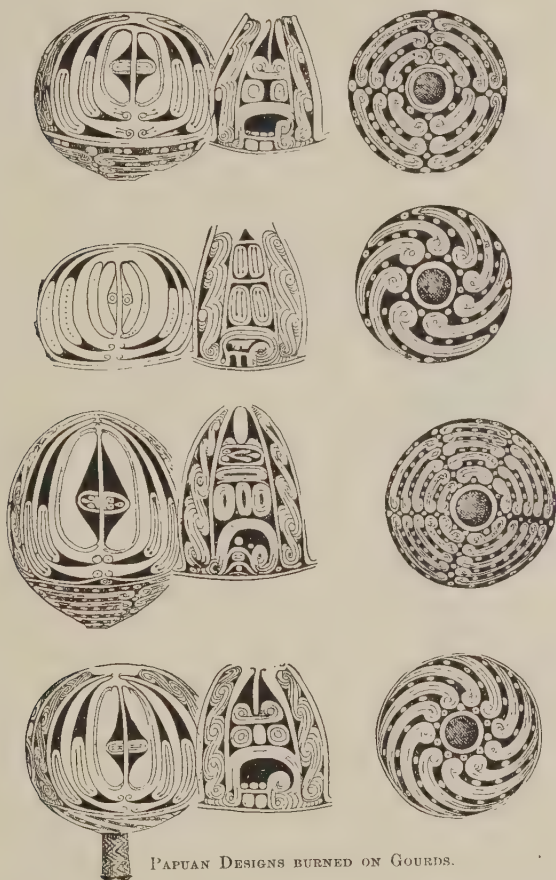


UTENSILS AND ORNAMENTS FROM SOUTHEASTERN NEW GUINEA. Those marked with a * come from the Trobriand Islands. 1-16, wooden knives used in chewing betel; 17-19, knives of cassowary bones; 20-29, 31, necklaces and bracelets (20-23, 25, 26, of snail shells; 27, of dog's teeth; 28, 29, 31, of braid; 24, man's lower jaw as bracelet); 30, braided finger ring; 32, 33, vessels for limewater; 35, 36, wooden bowls for pounding betel; 34, mussel shell as ornament for the brow; 37, bamboo knife for cutting off heads; 38, mussel shells as coin; 39, 40, combs; 41-44, headdresses of birds' feathers (41, feathers of parrots; 42, 44, feathers of birds of paradise; 43, feathers of cassowary and tail of marsupial).

like the note of the cuckoo, and the fish have lungs as well as gills. Professor Semon was especially interested in a species of this queer fish known as *Ceratodus forsteri*, which in early geological periods inhabited the waters of the whole globe, but is now confined to the Burnett and Mary Rivers in Queensland. As the result of his studies he corrects many current errors concerning its supposed amphibious character, and explains the real functions of its lungs in times of drought, and the advantages they afford in the struggle for existence over fishes which depend solely upon branchial respiration for the oxygenation of the blood. Owing to its close affinity with the *Protopterus annectens* of tropical Africa, many habits of the latter have been falsely ascribed to it, such as burying itself in a sort of cocoon of slime during the dry season until the rain dissolves this incasement and wakes it out of its summer sleep. When the streams dry up and are reduced to a succession of stagnant pools, the fishes which breathe only through the gills perish in large numbers by reason of the pollution of the water and consequent corruption of the air it contains; but the *Ceratodus* comes to the surface about once in thirty or forty minutes and fills its lungs with fresh air, and thus remains full of life and vigor in an abode that would be otherwise fatal to it. It is a curious fact that the two largest and fiercest marsupial beasts of prey, the dog-headed and wolfish *Tylacinus cynocephalus* and untamable *Dasyurus* or *Sarcophilus ursinus*, popularly called the Tasmanian devil, are extinct in Australia, and are now found only in Tasmania or Van Diemen's Land. Their disappearance is evidently due to the introduction of the dingo into Australia by the blacks, when they migrated to that country; for neither the so-called aborigines nor the dingo are indigenous in the strictest sense of the term. As the latter multiplied and went wild, it became the most formidable rival and foe of both the above-mentioned rapacious marsupials, and gradually exterminated them, so that they now exist only in Van Diemen's Land, where the dingo is unknown.

Exceedingly interesting and instructive are the sections of Semon's work which embody the results of his anthropological researches. The Negritos or native Australians are still living in a stage of culture corresponding to the palæolithic period or old stone age of primitive European man. Although inhabiting a land rich in ores, and especially in gold and copper, the use of metals is unknown to them except so far as they have obtained steel knives and tomahawks from white colonists with whom they have come in contact. All the weapons and implements manufactured by themselves are made of stone, bones, shells, wood, vegetable fibers, or the sinews of animals. The same is true of the Papuans of New Guinea,

yet been touched by this Promethean spark and quickened to a nobler life. All the faculties that contribute to their success as hunters have attained a wonderful degree of perfection, such as



PAPUAN DESIGNS BURNED ON GOURDS.

uncommonly keen powers of observation, unerring sense of locality, tenacious memory, and a most marvelous ability of drawing correct conclusions from the faintest signs and vestiges of wild animals as to their present abode and condition. The precision with which they hurl spears, clubs, and other rude weapons is as remarkable as their cunning in circumventing the alertest and wiliest game. Although ignorant of the use of bows and arrows, they have devised an excellent and exceedingly original substitute for them in the boomerang, a missile whose peculiar form and functions would seem to imply considerable knowledge of the science of projectiles

and of the action of the atmosphere on the surface of spiral curves, but which, like most great inventions, was unquestionably discovered by accident. Yet with all their sagacity and shrewdness, they are so low down in the scale of intelligence as not to be able to count more than five: one is "garro," two "boö," three "koromde," four "wogaro," and five "boö koromde," compounded of two and three;



PAPUAN CARVINGS ON COCOANUT VASE. This carving is cut into the surface of the coconut, a sort of intaglio, which the Italians call *graffiti*.

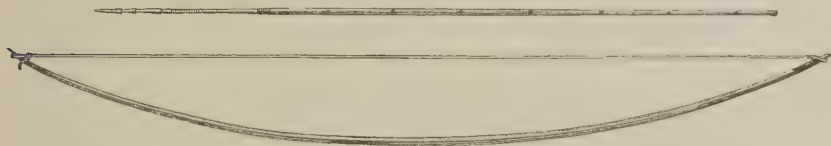
higher members are not differentiated, but lumped together as "meian," many. It would seem to us quite natural that they should be able to count at least as high as ten with the aid of the fingers of both hands, but such is not the case. An Australian can keep a record of twenty or thirty objects by making a notch for each one in a stick, but he has no name for this sum total and can not carry it in his head. Even the blacks who have learned a little English are incapable of using the English numerals beyond six with any degree of accuracy. Mackenzie, one of the most intelligent of the natives in Semon's service, could by this means count as far as ten and perform very simple processes of addition; thus, for example, if he caught three ant-eaters yesterday and four to-day, he knew that taken together they made seven.

But this was the extreme limit of his arithmetical computations; if he brought in three animals on each of three days, he could tell how many there were in all only by producing his tally; the multiplication of three by three was a mental operation far too complicated for him. As with number concepts, so with all abstract ideas, the Australians are incapable of forming them, and have therefore no words to express them. They have no collective names for animal and plant. They perceive very clearly the difference between the various species of venomous serpents in which their country abounds, but they have no terms by which to distinguish one genus from another, but call the whole family "wonge"; while "bui" is used to designate the harmless and edible serpents, of which the *Python spilotes* is the most conspicuous representative. Still more remarkable, perhaps, is the want of distinct designations for colors; they have separate words for the extremes of white, "bambar," and black, "ngurue,"* but not for the primary and composite colors red,

* The literal meaning of which is "dirty."

orange, yellow, blue, indigo, and violet, which they call "beiar," and it is doubtful whether they discriminate even with the eye between the more delicate hues.

A race of men devoid of the faculty of abstraction would necessarily be very deficient in religious conceptions. This is the case with the Australians, who do not show the faintest traces of a belief in the existence of supernatural beings, and therefore do not worship idols, perform sacrifices, or offer prayers. The ghosts they fear are the spirits of the dead, who, not having been properly buried, are doomed to walk the night. But, however great may be the terror inspired by these nocturnal spooks, no attempt is made to propitiate them; the easiest way of warding off their attacks is to huddle as closely as possible round the camp fire. Disease and death are not regarded as natural events, but dreaded as the work of the sorcerers of hostile tribes, whose influence can be counteracted only by sorcerers of their own tribe. In parts of southern and western Australia a somewhat higher stage of religious evolution has produced a vague sort of demonism with a crude cosmology, in which the founder of the tribe figures as the creator of the world. Here we have an example of ancestor worship as a primitive cult marking the transition from demonism to deism. The Australians have no myths or sagas in the sense of fictitious narrations or traditions of heroic achievements and historical events, but only the simplest tales of magic and wizardry, such as are common to the childhood of the race, and refer almost exclusively to the metamorphosis of men into animals. Thus a bad man was put to death by having spears hurled into him, and thereby changed into an *Echidna aculeata*, or porcupine ant-eater. To the minds of the natives this origin explains the mysterious character of this nocturnal creature, which wanders noiselessly about, and on the slightest suspicion of



PAPUAN BOW OF PALM WOOD, WITH STRING OF RATTAN FIBER AND BAMBOO ARROW.

danger vanishes into the earth as by enchantment. The koala, or phascolartetus, is also a magically transformed black man, and a charming story is told of the friendship between a child and a "wonge" (poisonous serpent), which the parents killed, whereupon the child pined away and died. This tale is told in a German *Märchen*, and the incident is said to have actually happened not long since in New England.



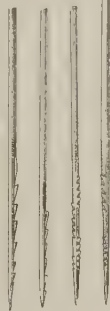
PAPUAN FISH
SPEAR. (AROMA.)

The organization of the Australian horde is essentially communistic. Personal property consists merely of such weapons and tools as each man can carry with him on his wanderings. The hunting grounds of every horde are well defined, and their boundaries respected by their neighbors. As a rule they live in peace, because there are no spoils to be won, and therefore no temptations to plundering expeditions. Most of the tribes choose a chief, usually a skillful hunter or sorcerer, whose counsel carries weight, but whose positive authority is very limited; he has no power to dictate laws to the community, or to impose his will arbitrarily on other members of the tribe. The checks upon individual liberty are very slight, and with the exception of a few general restrictions, prescribed by ancient custom, every man is perfectly free and independent in his actions, and even the children do pretty much as they please, and are in this respect far better off than the women, who are wholly subject to their husbands and made to bear the heat and burden of the day. Old men, owing to their long experience, exercise a general oversight and enjoy a certain authority, especially in the training of youth and in the formation of matrimonial connections; occasionally a man of strong character, superior intelligence, and conspicuous valor acquires great influence, as was the case with the famous chieftain of the Dieri, Jalina Piramurana; but what sovereignty he possesses is strictly personal, and does not affect the position of other members of his family, nor confer distinction upon his descendants. His pre-eminence does not lead to any recognition of hereditary rank, nor entitle his children to any privileges of birthright; they are on perfect equality with those of every other tribesman.

The Australians were practical Malthusians long before Malthus, and take the strictest precautions and the severest measures in order to prevent an increase of population beyond the means of subsistence. The fact that a score of herdsmen and more than twice as many husbandmen can live in comfort on an area of land that would furnish only scanty food for a single hunter renders it an imperative necessity for savages to keep their numbers within certain fixed

limits. This stability of the population is preserved by killing or exposing a certain proportion of infants, or by the castration or hypospadiac mutilation of a percentage of the boys before puberty. In some tribes every father of a family voluntarily submits to one of these radical operations after the birth of his second or third child. Personal sacrifice for the public good could surely not go further than this.

A fatal consequence of the smallness and isolation of the horde would be the constantly increasing necessity of marriages between persons closely related by ties of blood, and the effect of such unions would soon be perceptible in the physical and mental degeneracy of the race. The Dieri of southern Australia have a tradition that in the beginning fathers, mothers, brothers, sisters, and other next of kin were wont to intermarry indiscriminately, until the injurious results of these connections became apparent and led to their prohibition. First, marriages between parents and children, uncles and nieces, aunts and nephews, were forbidden, and the interdict was then extended to brothers and sisters, and finally to cousins. The result was that after a time all marriages between members of the same horde were prevented by the ban of consanguinity, so that they were obliged to enter into negotiations with other hordes for an interchange of marriageable maidens. The Kurnai, in Gipslan, forbid a man to take a wife who is more nearly related to him than in the fifth degree; but for a people who can neither read nor write or hardly count, and have therefore no genealogical records, it would be difficult to determine precisely the proximity of blood. A simpler and more effective system is that adopted by the Narinyeri, who inhabit the region of southern Australia at the mouth of Murray River. The tribe consists of eighteen independent hordes, and it is strictly forbidden for any man to marry into the horde of his father or his mother. By this regulation marriages between brothers and sisters and between cousins (unless they happen to be the children of two sisters who have not married into the same horde) are prevented. The children belong to the horde of the father, but the totem as the symbol of the family is inherited from the mother, and descends to the maternal line. Some tribes forbid matrimonial unions between persons having the same totem. This prohibition renders it impossible for a man to marry the descendants of his mother's sister, but permits him to marry the descendants of her brother, inasmuch as the



PAPUAN SPEARS.

latter derive their totem from their mother. Some tribes forbid these marriages by special enactments; others arrange the nearly



WEAPONS AND UTENSILS FROM SOUTHEASTERN NEW GUINEA. Those marked with a * come from the Trobriand Islands. 1-3, wooden clubs; 4, club with stone head; 5, war shield; 6, dance shield; 7, drum; 8-11, tobacco pipes of bamboo; 12, nest of baskets; 13, 14, skirts for women; 15-17, gourd flasks; 18-20, stone axes with handles; 21, bow of canoe.

related totems into larger groups, corresponding to what ethnographers call phratries, which can not intermarry. Without entering

into further details we may state that everything referring to the propagation of the species is carefully regulated, with the object of compelling men to take wives from alien hordes. The most important Australian feast is the celebration of the attainment of puberty by the young men, who on this occasion are subjected to severe ordeals and cruel tortures, such as circumcision, ghastly tattooing, or the extraction of one or two front teeth.

It has been asserted that the Australians represent a degenerate race, and that their remote ancestors had attained a far higher degree of civilization. Some paintings, which adorn the walls of caves on Glenelg River, in northwestern Australia, have been adduced in support of this hypothesis. It is evident, however, from the cast of the features, the cranial formation, the long garments, hats, and shoes of the figures in these sketches that they were made by shipwrecked Europeans, or perhaps Phœnicians. Everything in the life, language, traditions, habits, and general character of the Australians indicates a primitive people who, instead of deteriorating, have made some slight advancement in culture. The fact that they show no marks of near kinship with their neighboring islanders, the Papuans, Malays, or Maoris, tends to complicate the question of their origin. They possess many anthropological characteristics in common with the Dravidian hill tribes of the Deccan and the pre-Dravidian Veddas of Ceylon, such as the shape of the skull, the outlines of the face, and the waviness (in distinction from wooliness) of the hair; and these physical resemblances acquire additional significance through striking similarities in the Dravidian and Australian languages. If it be true as has been maintained, and seems highly probable, that the Caucasian race is of Dravidian origin, the Australians might claim to be very remote kinsmen of the Europeans, and their likeness to degenerate types of the latter is certainly quite strong.

As already indicated, the Papuans of New Guinea belong to the later or neolithic period of the stone age, and their superior culture is especially manifest in their artistic skill and taste. Their implements are made of wood, stone, shells, bones, and similar materials, and they have never learned the use of any metal. The hatchets, of feldspar, hornblende, and other stones, are not rudely chipped, but beautifully polished, and they manufacture vessels of burned clay in which to cook their food. Everything they fabricate is remarkable for elegance of form and delicacy of ornamentation. One can not but wonder at the perfection of workmanship wrought by stone tools—knives and daggers exquisitely carved out of wood or the bones of the cassowary, bracelets, frontlets, and necklaces of

shells, mother-of-pearl, dogs' teeth, and straw braids finely woven. A peculiar and apparently much-prized decoration for the wrist is the lower jaw of a foe, slain in battle, with tassels or other pendent ornaments. Mussel and cockle shells serve as currency, an advance from bimetallism to bivalvism that ought to be welcome to every advocate of cheap money. The most graceful and symmetrical designs are scratched on bamboo tobacco pipes, gourds, and cocoanuts, and burned in; and all these forms and figures reveal a refinement and a fertility of imagination and a facility of mechanical execution that excite admiration and astonishment. The most charming variety of arrangement is given to the simplest pattern wrought on curved surfaces in the purest style of arabesque. Like the neolithic men of Europe, they use bows and arrows, as well as clubs and spears, which are exceedingly graceful in shape; and compared with their strong and slender oars, ours are heavy and clumsy. The same is true of their sails of matting. They also bore holes in the heads of their stone hatchets for fastening the handles. Unlike the Australians, they have a fine sense of color, which they gratify by painting their shields white, red, and black, adorning their heads with the brilliant feathers of the bird-of-paradise, the parrot, and the cassowary; by variegated stripes in the women's short skirts, woven out of grasses, reeds, and the fibers of the cocoanut, and the "lines of beauty" with which they tattoo their dark-brown skin.

The constitution of the Papuan tribe, like that of the Australian horde, is radically democratic, but differs from it in being much less communistic. Private property, in distinction from tribal possession, begins with the tillage of the soil, and this general principle applies to the fields, houses, and tools of the Papuans; but the greed of gain has not yet been developed; each family cultivates land enough for its own subsistence, in addition to the products of the chase, and there is no distinction of rich and poor. The position of a chieftain confers upon him little authority, and whatever influence he exerts is due solely to his strong personal qualities, as is the case at present with the famous Koapena, of Aroma, a man equally distinguished for his valor in war and his discernment and impartiality in the administration of justice.

The houses are built on piles, like the lake dwellings of the primitive Swiss, and sometimes stand so far out in the sea that they are surrounded by water even at ebb tide. This construction of the villages is designed to protect the inhabitants less against the attacks of wild beasts than against the assaults of the fierce mountain tribes of the interior. A curious institution is the "Marea," or bachelors' clubhouse, as Semon calls it, in which boys, on attaining the age of puberty, take up their abode, and strangers are entertained. The

inmates are under the supervision of an elderly man, and their admission to this home of youthful celibates is attended with consider-

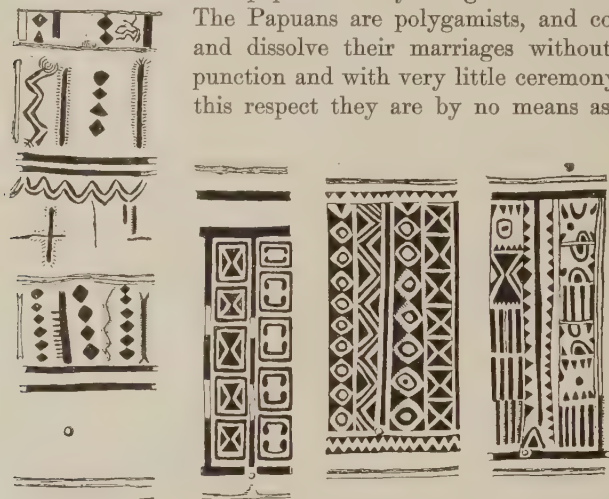


PAPUAN LAKE DWELLINGS, WITH A LAKATOI UNDER SAIL IN THE BACKGROUND.

able ceremony, when they are invested with a narrow girdle belt ("ihavuri"), which makes their waists look as slender as that of a

tightly laced girl. The interior of the "Marea" is adorned with weapons and trophies of war and the chase, and the posts are often beautifully carved. No woman is ever permitted to enter it, and its object is to promote chastity and prevent a too rapid increase of the population by illegitimate offspring.

The Papuans are polygamists, and contract and dissolve their marriages without compunction and with very little ceremony. In this respect they are by no means as strict



PAPUAN DESIGNS BURNED ON BAMBOO TOBACCO PIPES.

as the Australians, who are monogamists in practice, not because a plurality of wives is prohibited, but because no one is rich enough to maintain a harem.

The religious conceptions of the Papuans are crude, and their sole cult is a sort of worship of ancestors, to whose images, carved in wood, special reverence is paid. The strong attachment to kin, which forms the basis of this worship, finds an extremely unpleasant and unwholesome expression in long periods of mourning, and unwillingness to part with the bodies of the dead. Near relatives sleep for weeks, and even months, by the side of a decaying corpse, and smear themselves with the fetid exudations of putrefaction. The disconsolate widow blackens her body with coal dust, and covers herself from head to foot with a network, which she wears until it rots and falls to pieces, and meanwhile conscientiously abstains from washing. Finally, when the corpse is committed to the earth, it is buried directly under the house, in order to remain as near as possible to the sorrowing survivors, so that each family lives over its own private graveyard. The efforts of the Governor of British New Guinea to abolish these disgusting customs, which cause the spread of infectious diseases and often produce pestilence, have proved for

the most part unavailing, and created intense bitterness wherever they have been made.

The question of the origin and ethnography of the Papuans presents almost insuperable difficulties, and has not yet been satisfactorily solved, although it seems probable that the numerous tribes, notwithstanding their striking physical divergencies, are merely varieties of a general type and offshoots of a common stock. Whether they form an isolated and independent branch of the human family, or are akin to the dolichocephalous, dark-skinned, crisp-haired races of Africa and the islands of the Pacific Ocean, as Huxley suggests, is undetermined and perhaps indeterminable.



THE BRITISH ASSOCIATION AT TORONTO.

BY PROF. DANIEL S. MARTIN.

THE meeting of the British Association for the Advancement of Science, held in Toronto in August last, was an occasion of peculiar interest in many ways. The first visit of the association to America, thirteen years ago—the Montreal meeting of 1884—proved so successful and interesting that the invitation from Toronto, urgently pressed upon the body two years since, found a ready response, and has resulted in this important gathering. Our own association, meeting in Detroit during the previous week, had arranged the time and the place with reference to the other; and a large proportion of the American members, including most of those prominent in our association, came to Toronto and took a more or less active part.

The American members, indeed, were no strangers to Toronto, their experience when meeting in that city in 1889 having left a profound impression of the culture and the hospitality of that beautiful university town; so that all who had been there then were glad to revisit the place and renew their pleasing associations. Hence it came to pass that the recent meeting assumed an almost international character. Of the more than thirteen hundred people who attended, it is estimated that in a general way about one third were British members, one third Canadians, and one third from "the States."

Such meetings as this are good in every way. They bring together in bonds of common interest people widely separated by residence, by nationality, and by feeling; and they can not fail to help in the great object which all lovers of science and of humanity are

seeking to promote—the era of universal brotherhood, of “peace on earth and good will toward men.”

Some of the impressions of an American member attending this meeting, as to its varied aspects—scientific, political, and social—may be briefly presented in this article, which is intended less as a record of papers and proceedings than as a series of general notes.

Compared with the annual meetings of our own association, one fact attracts notice at once, as it did also at the American meeting in Toronto in 1889, to wit, the official recognition of such a gathering by the city and the provincial authorities, and the granting of liberal appropriations for the entertainment of the scientific visitors. In this case sums estimated at over twenty-five thousand dollars were appropriated, partly by the Dominion Government, partly by the Province of Ontario, and partly by the city, aside from private contributions and entertainments. Our association relies entirely upon the latter source; and its local committees in each place of meeting appeal wholly to wealthy and public-spirited citizens to defray the expenses of the occasion. Here comes to view one point of difference between our methods and those of a country equally free indeed, but in which there abides a slight flavor of that “paternalism” so jealously dreaded among our people.

It goes without saying, however, that in consequence of this liberal provision the meeting was brilliantly successful from a social point of view, the public gatherings and the viceregal reception by the Governor-General and his wife, Lady Aberdeen, being social functions of a very striking character. The scene at the great reception in the Parliament House was one never to be forgotten by those who witnessed it. The long line of invited guests moved slowly through the crowded hall, passing between statuelike guards, in scarlet uniforms or picturesque Highland plaids, to the low dais, where stood Lord and Lady Aberdeen, with Sir John Evans, president of the association, Lord Lister, the ex-president, Lord Kelvin, the greatest of living physicists, and a number of provincial and city officials. The spectacle was both brilliant and impressive, and illustrated a phase of life to which we Americans are strangers—the recognition of intellectual eminence with all the formal honors that official station and social rank can bestow.

At the opening meeting, on the first evening, Wednesday, August 18th, the spacious Massey Hall, in the heart of the city, was thronged. All around its horseshoe-shaped gallery were hung pennants, bearing the coats-of-arms of the past presidents of the association—an array of great names in the history of science. Herschel, Playfair, Tyndall, Huxley, Siemens, Lubbock, Rayleigh, among the great students and discoverers; the Prince Consort, Argyle, Salis-

bury, Vernon-Harcourt, among eminent public men; the Canadian Sir William Dawson, and many others, made indeed a "goodly company." Above the stage hung the arms of Toronto and of Evans. In a few very simple sentences Lord Lister handed over the presidency of the association to Sir John Evans, who then proceeded to deliver his formal address, to which reference will be made further on. At the close short speeches were made by the Governor-General, a man of tall and elegant aspect, of vivacious and rather youthful manner, and of great simplicity and cordiality in personal intercourse; then by Lord Kelvin, gray-haired and gray-bearded, wearing the elaborate insignia of the Grand Cross of the Victorian Order, who seconded the resolution of thanks to President Evans in a speech testifying his appreciation; and finally by Mayor Shaw, of Toronto, who put the resolution to vote. The manner of doing this differed constantly from ours; in no case were *ayes* called for, but the audience was requested to express its assent by applauding; this was done eagerly and warmly; and then, as the assemblage rose, it broke out into singing God Save the Queen as by a spontaneous impulse of loyalty.

President Evans is a bright, active-looking man, grizzled and elderly, but not aged, of medium stature, and with a pleasant though keen expression of countenance. There is nothing remarkable in his appearance, and one might pass him many times without imagining that he occupied so eminent a station in scientific circles. His address was one of much ability and great clearness, and developed some aspects of remarkable interest. His presentation of archæology as a true science, and of its relations to other departments, was admirable, and his concluding suggestions as to the immense break in time that intervenes between the palæolithic and the neolithic vestiges of man were striking and forceful.

The general feeling of cordiality toward the American visitors and members, which appeared in constant allusions, was early voiced in the address of Sir John Evans. After referring to the Montreal meeting of 1884, and now to this second visit of the British Association to Canada, he went on to say: "Our gathering this year presents a feature of entire novelty and extreme interest, inasmuch as the sister association of the United States of America—still mourning the loss of her illustrious president, Professor Cope—and some other learned societies, have made special arrangements to allow of their members coming here to join us. I need hardly say how welcome their presence is, nor how gladly we look forward to their taking part in our discussions and aiding us by interchange of thought. To such a meeting the term 'international' seems almost misapplied. It may rather be described as a family gathering, in which our rela-

tives . . . intimately connected with us by language, literature, and habits of thought, have spontaneously arranged to take part. . . . Here on the frontier between the two great English-speaking nations of the world, who is there that does not inwardly feel that anything which conduces to an intimacy between representatives of two countries, both of them actively engaged in the pursuit of science, may also, through such an intimacy, react on the affairs of daily life, and aid in preserving those cordial relations that have now for so many years existed between the great American Republic and the British Islands, with which her early foundations are indissolubly connected?" President Evans then referred very gracefully to the recent incident of the "log of the Mayflower" as "an interchange of courtesies which has excited the warmest feelings of approbation on both sides of the Atlantic—the return to its proper custodians of one of the most interesting of the relics of the Pilgrim Fathers"; and added the hope that this circumstance might be both an augury and a testimony of mutual regard and esteem between the nations.

This friendly and courteous tone toward Americans was indeed a marked and truly pleasing feature throughout the entire series of meetings; but, at the same time, no one could be misled. It was the tone of well-disposed neighbors, desiring to live in kind relations with us—the two peoples working out their problems and their destiny side by side, but separate. On the other hand, very striking and impressive were the tokens of Canadian national feeling, and Canadian love and loyalty to the empire and to the Queen. Every allusion to the sovereign, to the new ideal of the "Greater Britain," to the closer relationship between the mother land and the world-wide colonies, was received with outbursts of applause that betokened intense patriotic sentiment. The writer was much confirmed in the view, gained in previous visits to that region, that our people generally have no idea of the Canadians—of their resources and their spirit, of their national feeling and national pride, of their attachment to the empire of which they are a part. Joined to these there is more or less indicated a radical distrust of our methods and ideas, as compared with their own. Union or absorption with "the States" is as far as possible from the Canadian heart; and to one who considers impartially, it seems that a very long time must pass, and great changes be wrought in both countries, ere such an event can be other than a dream.

Nor is this a matter for regret; both peoples have their problems to solve and their work to accomplish; both have free institutions; both have energy, courage, and faith in themselves and their mission. As friends and brothers, each for itself, they can best develop this

vast continent on the lines of Anglo-Saxon civilization. An enforced and uncongenial union could have no benefit for either people.

In welcoming the association at the civic reception on Wednesday afternoon, previous to the opening of the meeting, speeches were made by Lord Aberdeen, for the Dominion Government, and Mr. Shaw, the mayor, for the city—the Governor of Ontario, who was to represent the province, being unwell and not present. Mayor Shaw, alluding to the American visitors, expressed the feeling of the Canadians very aptly by saying: “They mingle with our people on the friendliest of terms; we are delighted to have them come, and sorry when they go away. They are our good neighbors—the Americans—but they are only our neighbors. You are more closely related; you are our own kith and kin, . . . though separated by three thousand miles of ocean.”

President Evans’s address dealt, first, with archæology as a science; he drew a strong distinction between archæology and “anti-quarianism,” and developed clearly the relations that must exist between archæology, geology, and palæontology, in order to results of any established value. Then, reviewing the history of the science, in which he referred to the fact that the term “prehistoric” was first employed by the late Sir Daniel Wilson, President of the University of Toronto, he passed on to consider its scope. With regard to all questions of human remains or traces prior to the Glacial time, in the Pliocene or earlier, he could see no evidences at all trustworthy, and many elements of serious doubt. But, “when we return to palæolithic man,” he said, “it is satisfactory to feel that we are treading on comparatively secure ground, and that the discoveries of the last forty years in Britain alone enable us to a great extent to reconstitute his history.” He dwelt at length on the enormous amount of physical change that has taken place in the face of the country since the earlier palæolithic remains were deposited in the gravel beds and caves, and the immense lapse of time thereby indicated. Passing to the question of the origin of palæolithic man, he emphasized the view that he must have reached Britain and northern Europe by migration from a more genial climate, where food was more abundant and clothing less needful, rather than have originated in that inhospitable subarctic region. He then pointed out the wide diffusion of precisely similar implements to those of the Thames and the Somme Valleys, through numerous points of discovery in the Mediterranean region, into northern Africa southward even to Somaliland, and eastward through the valleys of the Nile and of the Euphrates to the Narbuddá Valley in India. Here they are associated with a Pleistocene fauna, closely akin to that of

Europe in palæolithic time, though perhaps a little earlier in type. Along these lines, and from one or other of these tropical sources, he would seek the distribution of palæolithic man. But what of neolithic man? Here President Evans dwelt emphatically on the absolutely unbridged chasm that separates the two types. The closing portion of palæolithic time was marked by the presence of the reindeer in Europe, and by a diminution in the size of the stone hatchets, apparently corresponding with the disappearance of the great mammals of the earlier time. But there is no indication of a ground or polished implement. He inclines to the view strongly that, owing to failure of food or other causes, man died out in northern and central Europe, possibly lingering in the Mediterranean region, as at the cave of Mentone, but that for the most part Europe became uninhabited, and remained so for a long period. When neolithic remains appear, the country has reached the physical conditions of the present time, and there is every indication of a new migration from the east and south. In Egypt and in India finely polished implements are abundant at certain points; and these doubtless indicate the pathway of the second great migration, from which we may more or less dimly trace the beginnings of historic development.

In closing, Sir John Evans urged the importance of establishing a bureau of ethnology for the Greater Britain, as of immense value, not only to the student of anthropology and archæology, but in the practical intercourse of Government officials, travelers, missionaries, and explorers with the native races on the borders of the empire. He paid a handsome tribute to the work of our own Bureau of Ethnology, and also to the researches being carried on in the Dominion, partly by the Government and partly by a committee of the association. The project of such a general bureau had been urged upon the Government by the last meeting, at Liverpool, but so far no action had resulted, the question being one of expense. But if, by a better understanding of native tribes and their modes of life and thought, one "little war" could be avoided, the cost of such an institution would speedily be saved.

The American Association was very much in evidence during the sessions, a number of our leading scientists taking prominent parts. This was most marked in the departments of Geology, Geography, and Anthropology; less so in the other sections, although some able representatives were present in nearly all of them, and most of the sectional committees included one or more names familiar to attendants at the American meetings.

In the section of Anthropology, presided over by Sir William Turner—a portly, florid old gentleman, with white whiskers and

a somewhat impressive manner—the first two papers read were by an American—and a lady—Miss Alice C. Fletcher, whose enthusiastic labors in the field of Indian folklore and traditions are familiar to all American scientists. Her interesting account of the significance of the “scalp-lock” among the Omahas, and of the mystical rites connected with it, giving an insight, as it did, into much that is obscure and unintelligible in the thought and the culture of these peoples, was received with great appreciation. Sir William Turner expressed not only his interest in the paper itself, but his admiration of the manner in which it had been given, and held up Miss Fletcher’s delivery as a model to those who should further address the section. Another of the British members, who followed in the discussion, said that one of the objects of interest that had led him to cross the ocean to this meeting was the hope of seeing and hearing Miss Fletcher. Prominent in this section were also Prof. F. W. Putnam, so long the efficient secretary and now chosen as the president of the American Association, and Prof. W J McGee, of the Bureau of Ethnology, Prof. Edward S. Morse, and Lieutenant Cushing, of Zuñi fame. Professor Putnam explained quite fully the great Jesup expedition, now partly in the field, for the ethnological study of the shores of the North Pacific, with the object of obtaining light on the origin of the North American races. This led to an exceedingly animated discussion on the question of Asiatic or other migrations, in which Professor Morse, at the request of the chairman, took a leading part. He presented very forcibly, from his long and familiar acquaintance with Japan and the east coast of Asia, the notable absence among the American coast peoples of many, or nearly all, of the habits and utensils that are most widely and commonly diffused on the Asiatic side. On the other hand, he was inclined to trace some curious art resemblances from the Mediterranean, by the Canary Islands, to South and Central America. Sir William Turner then called on Lieutenant Cushing, who dwelt upon the spontaneous origin of peculiar forms of utensils and decorations, and the need of caution in drawing conclusions from resemblances. Another most active and interesting discussion was that held on the last day, before a joint meeting of the departments of Anthropology and Geology, which was again opened by Professor Putnam, on the subject of the evidence of Glacial or Pre-glacial man in America. His remarks were principally an account of the argillite implements from the Trenton gravels, first discovered by Dr. C. C. Abbott, and now being systematically worked for by Professor Putnam’s assistants. He was followed by Professor Claypole, of Ohio, describing a finely chipped flint implement obtained in a deep well, firmly imbedded in glacial drift. The

discussion was then taken up by Sir John Evans, who at some length expressed his dissent from the views thus far presented, holding that nothing had yet been found in North America that would properly be called *palæolithic* in the Old World—i. e., presenting certain types of shaping, and associated with a properly extinct fauna. If the remains thus found and described are truly associated with glacial deposits, then we can only say that the neolithic period extends much farther back in America than it does in Europe. Professor McGee followed in a somewhat similar strain, questioning the age of the beds. Professors Putnam and Claypole responded; and the whole discussion was a battle of chieftains on both sides, of great interest, but with little definite result. The foreign archæologists are indisposed to admit the remote age of our American specimens; and it is plain that a great deal remains to be done ere archæology in this country can be definitely adjusted to a recognized correspondence with that of the European continent.

In the department of Geography, the opening address of Prof. J. Scott Keltie, on the areas of the globe that are yet unmapped and awaiting the explorer, included an able summing up of geographical progress during the Victorian era, embracing not only the opening of the unknown interior regions of Asia, Africa, and Australia, but the whole science of oceanography, and nearly the entire history of polar and circumpolar exploration. A figure of much interest was the explorer and "mighty hunter," F. C. Selous, of Africa, well known to all the tribes from the Zambesi to the Cape, whose paper, *On the Economic Value of Rhodesia*, was one that attracted much attention. It is said that Mr. Selous is the original after whom Rider Haggard drew his character of Alan Quatermain. Another leading figure was Sir George Robertson, the defender of the Chitral forts in the contest of 1896, who occupied the first place after the president's address with an illustrated paper on *Kafiristan* and the *Kafirs*. It was of interest also to see Prince Krapotkin, who presented papers in both this and the geological section, illustrated with maps, which he remarked had been kindly sent him from Russia after his escape from prison! American geographical work had a prominent place among the papers and proceedings of this section, as may be seen from the following list: Mr. Marcus Baker, *Institutions Engaged in Geographical Work in the United States*; Prof. W. M. Davis, *Geography as a University Subject*, and *The Coastal Plain of Maine*; Prof. R. E. Dodge, *Scientific Geography for Schools*; Mr. Henry Gannett (communicated by General Greely), *The Material Conditions and Growth of the United States*; Mr. F. H. Newell, *The Hydrography of the United States*; Prof. T. C. Mendenhall, *The Geographical Work of the United*

States Coast and Geodetic Survey; Prof. Charles D. Walcott (read by Prof. G. K. Gilbert), The Geographical Work of the United States Geological Survey.

The section of Geology was opened by the address of its president, Dr. G. M. Dawson, F. R. S., who gave an admirably clear and unbiased outline of the history and progress of Canadian geology, with special reference, of course, to the great labors and discoveries of Logan, Murray, Selwyn, and their co-workers in the Archæan and pre-Cambrian rocks of Canada. Professor Dawson well described and defined the Laurentian and Huronian terranes; but he does not favor the term Algonkian, and does not recognize it as expressing any definite system of rocks between the Huronian and the Cambrian. To go into any discussion of the many interesting papers in this section would be impossible within the limits of this sketch. A large amount of attention was given to glacial geology, both by American and Canadian contributors—Professors Chamberlin, Fairchild, Gilbert, Hitchcock, and Willis among the former, and Professors Coleman, Spencer, Taylor, and Tyrrell among the latter. Mr. Tyrrell's account of the succession of the glaciers over Canada was of great interest, indicating three successive centers of ice-sheet movement over the region between the Rocky Mountains and Hudson Bay—the first western, the second central, and the third eastern. In the discussion that followed, some of the British members expressed great interest in this view, as corresponding with indications of a similar shifting of the glacial center of movement in Europe, but in the opposite direction—from the east westward. Prof. John Milne, who gave the evening lecture on Earthquakes and Volcanoes, laid before the section a report—the second made to the association—on Seismological Investigations, in which he developed some striking views. He regards the ocean floors as the great areas of instability and the seat of by far the chief part of seismic movements, and believes it probable that important faultings and sinkages are constantly occurring, and that such peculiar abyssal areas as the "Tuscarora deep," etc., and the frequent accidents to ocean cables, are evidences of this condition.

Passing over the sections devoted to biological subjects, zoölogy, botany, and physiology, in all of which the presidential addresses and the papers and discussions were of abundant interest, a few words must be given to those that dealt with other classes of facts—physical, chemical, and sociological. The address of Professor Ramsay on The Evidences for the Existence of a yet Undiscovered Gas coming between helium and argon in its density and its properties, and describing his elaborately delicate experiments to separate it, if possible, from helium—though as yet without definite re-

sult—was a striking example of the combination of actual physical experimentation with the most abstruse theories and problems as to the properties of matter. The paper of Professor Meslans, of Nancy, on his own and Moissan's process for the separation and liquefaction of fluorine, was a matter of extraordinary interest, as the experiment was conducted in the presence of the section. The number of physical and electrical papers was very large, and no attempt can here be made to discuss them. Section A, Mathematical and Physical Science, has subdivisions or "departments"—one on electrical science, one on meteorology, one on general physics, etc.—all of which were active during the meeting.

The section on Economics and Statistics had a smaller number of papers, but of a class that has great attraction for many minds, especially at the present time. Our own Labor Commissioner, Mr. Carroll D. Wright, presented a paper on The Relation of the Employment of Women and Children to that of Men; and various other papers, relating largely to American and Canadian problems as to finance, trade, taxation, etc., were read and discussed.

It remains to allude briefly to a few of the more general public occasions. There were two evening lectures delivered in Massey Hall, before referred to: one on Friday, by Professor Roberts-Austen, F. R. S., on Canada's Metals, and the other on Monday, by Sir John Milne, on Earthquakes and Volcanoes. Both of these were interesting and instructive. Professor Roberts-Austen, who now is to succeed the Hon. Mr. Vernon Harcourt, who resigned the office of general secretary after fourteen years of service, presented a very full account of the resources of the great Dominion in metallic wealth; and Sir John Milne gave a large amount of novel and striking matter in regard to earthquakes and seismology, derived from long residence and study in the restless region of Japan. Some of his large projected illustrations of earthquake action, as photographed in that country, were highly impressive.

The two universities, Toronto and Trinity, which have their beautiful buildings and grounds in the city, had both arranged to confer honorary degrees upon the leading officers of the association at a formal "convocation." The one held by the University of Toronto came first, and took place in the large pavilion building of the Horticultural Gardens, on the afternoon of Friday, August 20th. The scene was highly interesting; the president of the university, Dr. Loudon, in his academic gown, with the red-lined hood of a doctor of laws, announced in each case to the audience the action of the institution in conferring the degree; then, turning to the recipient, he addressed him in Latin with the words of formal investiture; and then called him forward to the front of the platform to

sign his name in the volume of the university register, while the building rang with applause. The recipient, who also wore the red-lined hood of his new doctorate, then responded in a short address. In succession this form was gone through for Lord Kelvin, Lord Lister, Sir John Evans, and Mr. Hardy, Attorney General of the Dominion. Prof. Wolcott Gibbs, President of the American Association, was also similarly honored, but he was unable to be at Toronto in consequence of illness.

The addresses made by the recipients were interesting as being characteristic. Lord Kelvin spoke, in his distinctly Scotch accent, as a university man, of his interest in the university, and his pleasure in receiving its honors as a tribute not to himself personally, but to the interests of science, to which he had devoted his life. He rejoiced in the growth and progress of Toronto University, its beautiful site, its noble buildings, and its great influence on education throughout the province; himself the son of a university professor, growing up in the atmosphere of such institutions into his own career, first as a student and then as a professor, all his life had been spent in such relations, and he knew them and loved them best of all. Lord Lister spoke but briefly; he is a man of rather few words, with a sweet and genial benevolence of aspect that is characteristic of the kind, cultured, and aged physician. He could add little, he said, to what Lord Kelvin had already expressed, save to make some particular reference to the work of the university in establishing and advancing the high grade of medical education in the Dominion. Sir John Evans followed, and referred to the contrast between his own history and experience and that of Lord Kelvin, he never having been a university man, and having gained and learned whatever he had achieved without those early advantages and associations that were so rich and attractive. Other addresses were made by Mr. Hardy and the viceroy, Lord Aberdeen.

The convocation at Trinity University was similar in general character and aspect; but the beautiful chapel in which it was held was so crowded that the writer was unable to enter, and can not describe it in detail.

The *conversazione*, held on the last evening before the close of the meeting, in the main building of Toronto University, was a brilliant social reception, less formal than that of the viceroy, and unmarked by the military guards that formed so conspicuous a feature at the Parliament House, but in other respects equally handsome and equally thronged.

After the adjournment, on Wednesday, a banquet was given to the chief officers of the association, which is described by those present as again a very brilliant scene. The speeches that followed

have been more or less reported in our public press, in particular that of Mr. James Bryce, on Jingoism, which has naturally attracted considerable notice. Of this, and the many kind and enthusiastic words that were uttered on this occasion, there is no space here to remark. Suffice it to say that there is a profound belief in the minds of cultivated and thoughtful men of both Britain and America that the real heart of each nation is friendly to the other, and that the harsh and reckless utterances of a sensational or partisan press are no index to the true feelings of the people. Lord Lister expressed this precise idea in a brief conversation with the writer, as Mr. Bryce has also most forcibly done in both public and private relations.

Other aspects of the meeting must perforce be omitted, although there is much temptation to linger upon them. The private hospitality so freely shown, the attractive lawn parties in beautiful grounds and houses of the city, such as "The Grange," where Prof. Goldwin Smith received the visitors, and many like occasions of social converse; the labors of the Local Committee, from the hard-worked and efficient secretary, Professor Macallum, to the many courteous assistants whose names are unrecognized and overlooked; the immense impetus given by such a meeting to many forms of scientific interest in the community and the Dominion, to bear fruit and achieve important results for years to come—all these, and many more, are subjects of delightful remembrance. For us, in "the States," there should be also the influence of a healthful pride and a kindly rivalry to strengthen and build up our own association, and to appreciate more than perhaps we have before its importance to the country and to science. The next meeting will signalize its first half century, and it will be held, very fittingly, in Boston. President Putnam, at the closing banquet, invited the British members to come over and be our guests in 1898. At all events, let us endeavor to make that meeting a memorable success, as was the British meeting at Toronto.

PROJECTS are in agitation in England, France, and Germany for taming African elephants and training them to work. It is proposed to establish stations at suitable points in settlements near regions inhabited by elephants, to which young animals may be brought, suitably cared for, and broken in by skilled trainers imported from Asia.

"SUCH is the innate folly of man," says Sir William Martin Conway, in his *First Crossing of Spitzbergen*, "that when he sees a beautiful view, he desires to be in the midst of it. . . . But the beauty is not there, but here, whence it is beheld. Not on that golden surface of the rippled sea, not on that rose-tinted peak, but here. Tell a man this a thousand times; repeat it to yourself; it is useless."

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(Lowell Institute Lectures, 1896.)

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X.—GERMANY.

GERMANIA! A word entirely foreign to the Teutonic speech of northern Europe. Deutschland then, the country of the Deutsch—not Dutch, for they are really Netherlands. What do these words mean? What territories, what peoples do they comprehend? The Austrians speak as pure German as the Prussians; yet the defeat of Königgratz, barely a generation ago, left them outside of Germany. On the other hand, the Polish peasants of eastern Prussia, with their purely Slavic language, are accounted Germans in good standing to-day.*

Ambiguous linguistically, do these words, German or Deutsch, imply any temperamental or religious unity? This can not be, for the main participants in the Thirty Years' War—

“Fighting for conciliation,
And hating each other for the love of God”—

were Germans. Historians are accustomed to identify the division line of belief in this conflict with that of racial origin. They are pleased to make the independent, liberty-loving spirit of the Teutonic race responsible for the Protestant Reformation. Let us not be too sure about that. Such bold generalizations are often misleading. Racial boundaries are not so simple in outline. The Prussians and the Prussian Saxons—Martin Luther was one—were anything but pure Teutons racially; this did not prevent them from siding with Prince Christian and Gustavus Adolphus. And then there were the Bohemians who began the revolt, and the Swiss Calvinists, and the rebels of the Peasants' War in Würtemberg! None of these were ethnically Teutons. Let us beware of such ascriptions of a monopoly of virtue or intellect to any given race, however comforting they may be to us who are of Teutonic descent. Modern Germany, to be sure, is half Catholic and half Protestant, but the division was not of ethnic origin in any sense. Thus the word German is even more nondescript religiously than linguistically. In

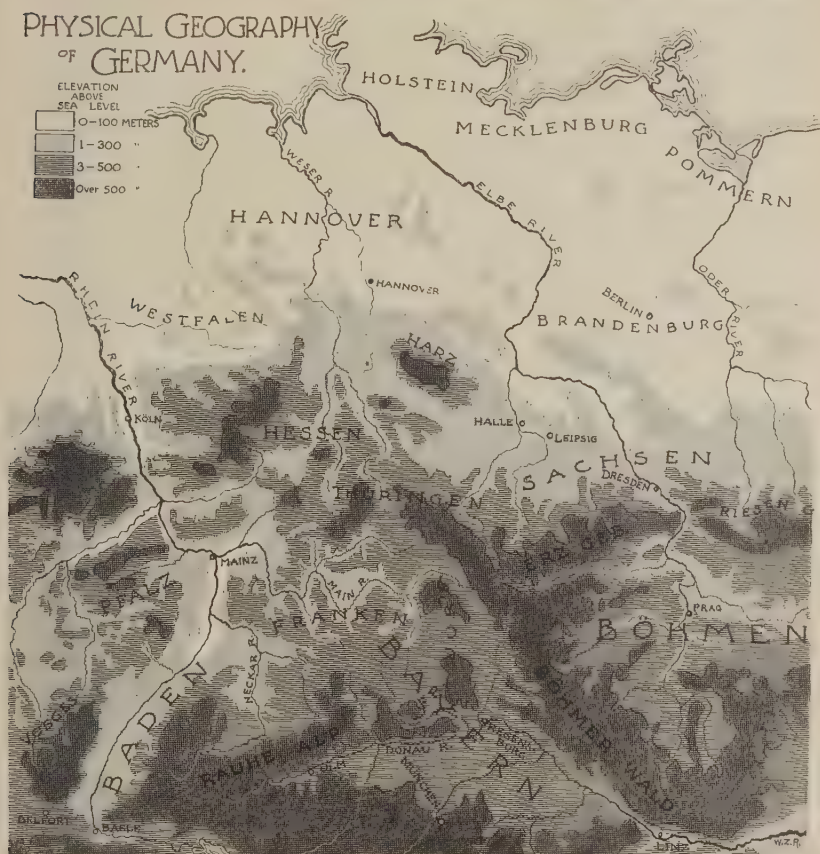
* Fine map by von Fircks in Zeits. kön. preuss. statistischen Bureaus, Berlin, xxxiii, 1893, pp. 189–296.

short, it applies to-day to an entirely artificial concept—nationality—the product of time and place. Religious, linguistic, and in large measure political differences have merged themselves in a sympathetic unity. Thus has the original meaning of the word Deutsch—a people or nation—come to its truest expression at last.

The fact is that nationality need not of necessity imply any greater uniformity of ethnic origin than of either linguistic or religious affiliations. Such we have seen is the case in France and Italy. Especially clear are the two distinct racial elements in the latter case. Now in Germany, on the northern slopes of the main European watershed, we are confronted with a great nation, whose constituent parts are equally divergent in physical origin. With the shifting of scene, new actors participate, although the plot is ever the same. This time it is not a question of the Alpine and Mediterranean races. The Alpine element remains, but the Teuton replaces the other. Briefly stated, the situation is this: northwestern Germany—Hanover, Schleswig-Holstein, Westphalia—is distinctly allied to the physical type of the Swedes, Norwegians, and Danes. All the remainder of the empire—no, not even excluding Prussia, east of the Elbe—is less Teutonic in type, until finally in the essentially Alpine broad-headed populations of Baden, Württemberg, and Bavaria in the south the Teutonic race passes from view. The only difference, then, between Germany and France in respect of race is that the northern country has a little more Teutonic blood in it. As for that portion of the empire which was two generations ago politically distinct from Prussia, the South German Confederation, it is in no wise racially distinguishable from central France. Thus has political history perverted ethnology; and, notwithstanding, each nation is probably the better for the blend, however loath it may be to acknowledge it.*

* It is to be regretted that so many of our authorities on Germany have relied upon craniometric investigations rather than study of the living population. Even more grievous is the paucity of evidence regarding the northeastern third of the empire. In our Bibliography of the Anthropology and Ethnology of Europe, to appear shortly in a Bulletin of the Boston Public Library, we have indexed all our authorities, where they may be found *in extenso*. In this place we may merely mention the larger standard works arranged chronologically: H. Welcker, *Kraniologische Mittheilungen*, Archiv f. Anth., i, pp. 89–160, 1862. A. Ecker, *Crania Germaniæ meridionalis occidentalis*, Freiburg i. B., 1865. H. von Hölder *Zusammenstellung der in Württemberg vorkommenden Schädelformen*, Stuttgart, 1876. R. Virchow, *Beiträge zur physischen Anthropologie der Deutschen u. s. w.*, Abh. kön. Akad. Wiss., Berlin, 1876; and also *Gesamtbericht über die Erhebungen über die Farbe der Schulkinder in Deutschland*, Archiv f. Anth., xvi, pp. 275–477, 1886. J. Ranke, *Beiträge zur physischen Anthropologie der Bayern*, München, 1883. O. Ammon, *Natürliche Auslese beim Menschen*, Karlsruhe i. B., 1893, and in other monographs (*vide* bibliography). Equally important, although not restricted to Germany alone, are the papers by Prof. J. Kollmann, especially his *Schädel aus alten Grabstätten Bayerns*, in *Beit. zur Anth. Bayerns*,

First, and always, as to the physical geography of the country: everything ethnically depends upon that. It is depicted upon the



It will be observed that in all cases we have preserved the German spelling of geographical names. This is done for special reasons of weight, which can not be explained in this place.

map on this page, which represents elevation above sea level by means of darkening tints, the mountainous regions being generally designated by the broad bands of shading. Draw a line from

München, i, 1877, pp. 150-226. Certain technical points concerning these writers we have discussed in *L'Anthropologie*, Paris, vii, 1896, pp. 619 *seq.* For ethnographic details the older work of Zeuss (*vide bibliography*) is now supplanted by that of K. Müllenhof, which may confidently be relied upon. Howorth, in *Jour. Anth. Inst.*, London, vi and vii, is also good. For a convenient *résumé* of our knowledge, both ethnographic and anthropological, consult Hervé, Les Germaines, in *Revue mensuelle de l'École d'Anthropologie*, Paris, vii, 1897, pp. 65-87.

Breslau, or, since that lies just off our map, let us say from Dresden to the city of Hanover, and thence to Cologne. Such a line roughly divides the uplands from the plains. To the north stretches away the open, flat, sandy expanse of Hanover, Oldenburg, Pomerania, Brandenburg, and Prussia. This vast extent of country is mainly below one hundred metres in elevation above the sea. South of our division line the land rises more or less abruptly to a region upward of a thousand feet in altitude. In Bavaria, Württemberg, and Bohemia lie extensive table lands fully five hundred feet higher even than this, giving place finally to the high Alps. The transition from north to south is particularly emphasized along our artificial division line by the fringe of mountains which lie along it, including the Riesen and Erzgebirge bounding Bohemia, the heavily



TEUTONIC BLOND TYPE. Mainz. Stature, 1.75 metre. Cephalic Index, 75.

wooded mountains of Thüringen, and farther west the Harz, the Waldgebirge, and the Westerwald by Cologne. On this side, the highlands across the narrow gully of the Rhine River have already been described in speaking of the Ardennes uplands in France and Belgium. Their extension in Germany is known as the Rhenish plateau.

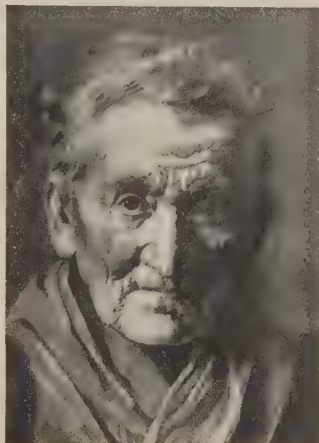
For the sake of unity of treatment, preserving the general form of argument already adopted in the cases of France and Italy, let us consider the head form of the people first. At once we perceive a progressive broadening of the heads, that is, an increase of cephalic index, as we travel outward from the northwestern corner of the empire in the vicinity of Denmark. Thus we pass from a head form identical with that of the Scandinavians to one in the south in no wise

distinguishable from the Swiss, the Austrian, and other Alpine types in France and northern Italy. Our three accompanying por-



MIXED TYPE. Achern i. Baden. Stature, 1.62 metre. Cephalic Index, 83.3.

traits will serve to illustrate this gradual change of physical type.* The first is a pure blond Teuton, blue-eyed, fair-haired, with the characteristically long head and narrow, oval face of his race. The features are clear cut, the nose finely molded. Such is the model common in the upper classes all over Germany. Among the peasants it becomes more and more frequent as we approach the Danish peninsula. Here in these northwestern provinces it predominates, but gives place slowly to a mixed and broader-headed type as we pass eastward into Prussia. The intermediate type of head form prevalent in regions of ethnic intermixture is depicted in our second portrait. In this particular case the eyes were blue, but the hair was brown. This variety occurs all along the division line between upland and plain, which we traced a few moments ago. It appears that it is indigenous in Thüringen, the Hesses, and, in fact,



DISHARMONIC MIXED TYPE.
Bavarian Tyrol.

* For these photographs I am indebted to my very good friend Dr. Otto Ammon of Karlsruhe i. B., whose work we have noted elsewhere.

all the isolated bits of highland down to the Baltic plain. Oftentimes the result of intermixture is a disharmonism, in which the broad Alpine head is conjoined with the longish face of the Teuton, or the reverse. An example of the first combination is depicted herewith. Types of this kind occurring everywhere in the south prove that the Teutonic invaders were finally outnumbered by the indigenous Alpine inhabitants. The pure, unmixed Alpine race finds its expression in the plateaus of Bavaria and Würtemberg, in the Schwarzwald, the Rauhe Alp, and parts of the Thüringerwald. Such is our third type, with its rounded face and skull foreshortened from front to back. Our representative here photographed was dark brown both in hair and eyes, nose rather irregular, less finely molded perhaps; certainly considerably broader at the nostrils than in the Teutons. At the same time the stature was short, only five feet one and a half



ALPINE TYPE. Oberwolfach i. Baden. Stature, 1.59 metre. Cephalic Index, 86.5.

inches, with a correspondingly stocky figure. Other examples of these several types will be found scattered through the following pages. We need not enter into further details. The facts speak for themselves. There can be no doubt of two distinct races of men.

It is especially important to emphasize the fact that the heads broaden not only from the neighborhood of Denmark southward but toward the east as well. This raises what was once a most delicate question. What is the place of the Prussians among the other peoples of modern Germany? The political supremacy of the house of Hohenzollern in the Diet of the empire and the whilom rivalry and jealousy of the other states made it once a matter of some con-

cern to determine this point. Happily for us, such questions have no terrors to-day. We have already seen how securely nationality may rest upon heterogeneity of physical descent. Be that as it may, it seems to be certain that the peasantry of Prussia is far from being purely Teutonic in physical type. We should expect this to be the case, of course, in those eastern provinces, Posen and Silesia, which still retain their Slavic languages as evidence of former political independence. These ought normally to be allied to Russia and eastern Europe, as we have already observed. But as to Brandenburg—the provinces about Berlin. How about them? Do they also betray signs of an intermixture with the broad-headed Alpine race, of which the Slavs are part? It seems to be so indeed. Germany on the east shades off imperceptibly into Lithuania and the Polish provinces of Russia. Little by little the heads broaden to an index rising eighty-three. Whether this is a product of historic expansion we may discuss later. For the present we may accept it as a fact.*

The race question in Germany came to the front some years ago under rather peculiar circumstances. Shortly after the close of the Franco-Prussian War, while the sting of defeat was still smarting in France, de Quatrefages, an eminent anthropologist at Paris, promulgated the theory, afterward published in a *brochure* entitled *The Prussian Race*, that the dominant people in Germany were not Teutons at all, but were directly descended from the Finns. Being nothing but Finns, they were to be classed with the Lapps and other peoples of western Russia. As a consequence they were alien to Germany—barbarians, ruling by the sword alone. The political effect of such a theory, emanating from so high an authority, may well be imagined. Coming at a time of profound national humiliation in France, when bitter jealousies were still rife among the Germans, the book created a profound sensation. It must be confessed that the tone of the work was by no means judicial, although it was respectably scientific in its outward form. Thus the chapter in it describing the bombardment of the Musée d'Histoire Naturelle, of which de Quatrefages was the director, intended to prove the anti-civilized proclivities of the hated conquerors, could not in the nature of things be entirely dispassionate. The Parisian press, as may be imagined, was not slow to take advantage of such an opportunity. Articles of de Quatrefages in the *Revue de Deux Mondes* were everywhere quoted, with such additions as seemed fitting under

* Authorities are cited in our article in *L'Anthropologie*, Paris, vii, 1896, p. 619 *seq.* Kollmann, in *Archiv f. Anth.*, xiii, 1881, p. 117 *seq.*, gives many references. See also Lithuania, Esthonia, etc., in our bibliography above mentioned. Virchow admits it himself, *Alte Berliner Schädel*, in *Verh. Berl. Ges. f. Anth.*, 1880, p. 224.

the circumstances. The affair promised to become an international incident.

A champion of the Prussians was not hard to find. Professor Virchow of Berlin, set himself at work to disprove the theory which thus damned the dominant people of the empire. The controversy, half political and half scientific, waxed hot at times, both disputants being held victorious by their own people.* One great benefit flowed indirectly from it all, however. The German government was induced to authorize the official census of the color of hair and eyes of the six million school children of the empire which we have so often mentioned in these pages. One of the resultant maps we have reproduced in this article. It established beyond question the differences in pigmentation between the north and south of Germany. At the same time it showed the similarity in blondness between all the peoples along the Baltic. The Hohenzollern territory was as Teutonic in this respect as the Hanoverian. Thus far had the Prussians vindicated their ethnic reputation. It is profoundly to be regretted that the investigation was not extended by a comprehensive census either of stature or of the head form of adults, similar to those conducted in other countries. Such a project was, in fact, sidetracked in favor of the census of school children. Whether politically inspired, or whether considered derogatory to the noble profession of arms, the Prussian army is forbidden for all scientific investigations of this kind, despite the efforts of Virchow and other eminent authorities in that direction; so that data are still scrappy, as we have seen.

To an American the apparent unwillingness on the part of the Germans boldly to own up to the radical ethnic differences which exist between north and south is incomprehensible. It seems to be not improbable that the Teutonic blond race has so persistently been apotheosized by the Germans themselves as the original Aryan civilizer of Europe, that to acknowledge any other racial descent has come to be considered as a confession of humble origin. Or, more likely still, this prejudice in favor of Teutonism is an unconscious reflection from the shining fact that this type is widely prevalent among the aristocracy all over Europe. Whether Aryan or not, it certainly predominates in the ruling classes to-day. At all events, the attempt is constantly being made to prove that the ethnic contrasts between north and south are the product of environmental influences, and not a heritage from widely different ancestry. This is not an impossibility in respect of pigmentation; but it can

* Under the dates of 1871-'72, the articles by the two principal disputants will be found in our Bibliography of the Anthropology of Europe, above mentioned.

not be pushed too far. Thus Ranke of Munich, most eminent authority, has striven for years to account for the broad-headedness of the Bavarian population by making it a product of the elevated and often mountainous character of the country. This being proved, it would follow that the Bavarians still were ethnically Teutonic, merely fallen from dolichocephalic grace by reason of change of outward circumstances. This theory seems to be completely incapable of proof; for, as Ranke himself has shown,* the effect of the malnutrition generally incident to an abode at considerable altitudes is entirely in the opposite direction. Among poorly nourished children in factory towns, for example, the immediate effect is to cause an arrest of development about the temples, exactly where the broad-headed Alpine race is so well formed. It is strange to us in America to find how important such matters may become by reason of a social differentiation between races. Another potent example is offered in Russia. The late Professor Zograf, of Moscow, than whom none stood higher as an anthropologist in Russia, confronted by the same division of ethnic types as Germany contains, has positively identified the blond long-headed one as the original Slav.† This may or may not be true; it may be gratifying to have it so. To us the evidence apparently points the other way. In Russia, however, no other conclusion than this would be tolerated for an instant. Pan-Slavism prevails even in science.

After this *excursus*, let us come back to statistics and examine the evidence from the study of blondes and brunettes among the school children. Our double-page map, as will be observed, includes not only the German Empire but Switzerland, Belgium, and Austria, down to the Adriatic as well—exclusive, however, of Hungary. Virchow's great census in Germany was extended over the other countries in quick succession.‡ The system employed was identical in all, save in Belgium; and even here the definition of brunettes was the same, although the term blond was made more comprehensive. For this reason the results are strictly comparable so far as our map is concerned. A great defect in all such investigations on children, as we have already stated, lies in the tendency to a darkening of hair and eyes with growth. This is probably intensified in the more southern countries, so that our shading probably fails to indicate the full extent of the progressive brunetteness in this direction. North of the Alps, however, we may accept its evidence provisionally, at all events.

* Beiträge zur Anth. der Bayern, i, 1877, pp. 232 *seq.*, and 285; also *ibid.*, ii, 1879, pp. 75 *seq.*

† *Vide* our Bibliography of Europe.

‡ For Austria, see Schimmer, 1884; for Switzerland, Kollmann, 1883; and for Belgium, Vanderkindere, 1879, in our Bibliography. Full titles are there given.

One or two points on this map deserve mention, after noting the general contrast between northern and southern Germany. Observe how sharp the transition from light to dark becomes all around the mountainous boundaries of Bohemia. Here we pass suddenly from Germanic into foreign territory; for the Bohemian Czechs are truly Slavic in origin as in speech. One wonders if it is purely chance that so accentuated a brunette spot occurs about Prague. That is the capital city, the nucleus of the nation. As for the German-speaking Austrians, they are in no wise distinguishable in pigmentation from the Slovaks, Slovenes, Czechs, or other Slavic neighbors all about them. The second point which we would emphasize is the striking way in which blondness seems to have trickled down, so to speak, through Württemberg, and even as far as the Swiss frontier. We have already called attention to this in a preceding article. It will bear repetition here. The Rhine Valley bears no relation to it. At first sight, the infiltration seems to have taken place directly across country. Closer inspection shows that it coincides with other evidence derived from the study of the head form in the same district. Especially noteworthy are the peculiarities of Franconia (Franken), the southern edge of which appears as the light-dotted area on our map on page 61. This Franconian long-headed district extends over nearly the whole basin of the Main River well into Bavaria, and, as our map shows, up along the Neckar. It constitutes by far the clearest case of wholesale Teutonic colonization south of the Baltic plain. This is probably the cause of the wedge of blondness upon our large map. Historians tell us the Franks were Teutons, and here is where they first settled.

It is interesting to observe how this Teutonization of Franconia, manifested in our map of brunette traits, tallies with geographical probability. Here is just where we should be led to expect a settlement in any case. Turn back for a moment to our map of physical geography. As the invaders pushed southward, they would naturally avoid the infertile uplands bordering Bohemia, and on the west the difficult, heavily forested Rhenish plateau. Each of these wings of the German upland are of a primitive geological formation, agriculturally unpropitious, especially as compared with Thüringen—rugged, but well watered and kindly, as it is. Suppose our Teutonic tribes to ascend the Weser and its affluents, the Fulda and Werra, or perhaps the narrow gully of the Rhine to Mainz. There would be little to tempt them to turn back to the wooded country, either of Hesse or Thüringen. What was more natural, however, than that sedimentation should take place on reaching the fertile valley of the Main? Its basin, light dotted on our map, with that of the

Neckar just south of it, forms as a consequence the great Teutonic colony in the Alpine highlands. Corroborative testimony of place names also exists. Canon Taylor, for example, states that this district is a hotbed of Teutonic, mainly Saxon, village and local names. It closely resembles parts of England in this respect. Further wholesale colonization to the south seems to have been discouraged by the forbidding Rauhe Alp or Swabian Jura. The Teutonic characteristics have heaped up all along its northern edge, as our map on page 61 shows; but the mountains themselves remain strongholds of the broad-headed type. A considerable colony of dolichocephaly lies on the other side of them, seemingly bearing some relation to the Allgäuer dialect. Beyond this all is Alpine in type. Allemanni and Helvetii have left no trace of their Teutonism in the living population.

Viewed in the light of these geographical facts, the contrast in brunetteness between Würtemberg and Bavaria is readily explained. The fluvial portals of the Bavarian plateau open to the east, not the north. We know that the Boii (Bohemians) and the Bajovars or ancient Bavarians came from this side, following up the course of the Danube. Their names are Keltic, their physical characteristics seem to have been so as well.*

One more physical trait remains for consideration before we pass from the present living population to discuss certain great historic events in Germany which have left their imprint upon the people. We refer to stature.† The patent fact is, of course, that the areas of blondness and of dolichocephaly are also centers of remarkably tall stature. Our three portrait types illustrated this clearly. The first grenadier was five feet nine inches in height (1.75 metre); the mixed type was shorter by about five inches (1.62 metre), while the conscript from the recesses of the Black Forest in Baden stood but five feet two inches in his stockings (1.59 metre). This last case is a bit extreme; averages seldom fall in Germany below five feet five inches. Local variations are common, as elsewhere; crowded city life depresses the average, prosperity raises it; but underneath it all the racial characteristic, so inherent in the Teutons, makes itself felt wherever they have penetrated the territory of the short and sturdy Alpine race. A few anomalies in the distribution of this trait should be noted in passing. In contravention of the gen-

* *Vide* H. Ranke, *Zur Craniologie der Kelten*, Beiträge zur Anth. Bayern, vi, 1885, pp. 109-121; and J. Ranke, in *ibid.*, iii, 1880, pp. 149 *seq.*

† Ranke, 1881, has mapped it for Bavaria; Ecker, 1876, and Ammon, 1894, for Baden; Meisner, 1889, for Schleswig-Holstein; Reischen, 1889, for part of Prussia, etc. Titles are given in our Bibliography above mentioned; for additional ones see index for "Germany, stature."

eral law, that the severity of climate and poverty of environment in mountainous districts exert a depressing influence upon stature, the Bavarian Alps and the Böhmerwald contain a population distinctly above the general average in the great plateau south of Regensburg. (See map of physical geography.) This is all the more extraordinary, since these mountaineers are Alpinely broad-headed and relatively brunette to an extreme. It would be a highly discouraging combination did we not remember that the great Bavarian plateau is itself of considerable altitude; even then one is led to suspect that some process of selection has been at work to compass such a result. For if we turn to the Black Forest, we there find our racial law holds good. Wolfach, from which our portrait type was taken, exemplifies it completely. Here, on the high plateau known as Die Baar, the average stature falls below five feet four inches, the lowest recorded, I believe, in the empire.

Two great events in the history of northern Europe have profound significance for the anthropologist. The first is the marvelous expansion of the Germans, about the time of the fall of Rome; the second is the corresponding immigration of Slavic hordes from the east. Both of these were potent enough to leave results persistent to this day.

We know nothing of the German tribes until about 100 B. C. Suddenly they loom up in the north, aggressive foes of the Romans. For some time they were held in check by the stubborn resistance of the legions, until finally, when the restraining hand of Rome was withdrawn, they spread all over western Europe in the fourth and fifth centuries of our era. Such are the well-known historic facts. Let us see what archæology may add to them. The first investigators of ancient burial grounds in southern Germany unearthed two distinct types of skulls. The round-headed variety was quite like that of the modern peasantry roundabout. The other dolichocephalic type was less frequent, but strongly marked in places. An additional feature of these latter was noted at once. They were generally found in burial places of a peculiar kind. An easterly sloping hill was especially preferred, on which the skeletons lay feet toward the rising sun—probably a matter of religious importance. The bodies were also regularly disposed in long rows, side by side, a circumstance which led Ecker to term them *Reihengräber*, or row-graves. Other archæologists, by a study of the personal effects in the graves, succeeded in identifying these people with the tall, blond Teutonic invaders from the north. Such graves are found all through Germany as far north as Thüringia. They bear wit-

ness that Teutonic blood infiltrated through the whole population. The relative intensity of intermixture varied greatly, however, from place to place. Our map on this page shows in a broad way its geographical distribution in Württemberg and Baden, so far as it can be measured by the head form. Reihengräber and cephalic



HEAD-FORM AND DIALECTS IN WÜRTTEMBERG.

AFTER VON HÖLDER '76.

Plain white, the absence of shading on this map denotes an intermediate type of head form incident upon intermixture.

index corroborate one another. The most considerable occupation seems to have been, as we have said, in Franconia. We have already adduced some geographical reasons for the settlement in this place. Still another one remains to be noted. The Frankish race spot seems to lie just outside the great wall, the *Limes Romanus*, which the Emperor Tiberius and his successors built to hold the barbarians in check. Von Hölder has indicated the relation between the long-headed Teutonic areas and this ancient political boundary. Our

map is adapted from his.* The modern limits of the Frankish dialect also coincide with it in great part. Here, just outside the Roman walls, the Burgundians, Helvetians, and Franks undoubtedly were massed for a long time.

The Teutons, in invading the territory of the indigenous Alpine population, only succeeded in displacing the aborigines in part. They followed up the rivers, took possession of the open plains; but everywhere else left the natives in relative purity. This accounts in some measure for the great differentiation between people of mountain and plain all over this part of Europe, to which we have constantly adverted. It endows the whole event with the character of a great social movement, rather than of a sudden military occupation. We can not too fully guard against the hasty assumption that this Teutonic expansion was entirely a forcible dispossession of one people by another. It may have been so on the surface; but its results are too universal to be ascribed to that alone. A revolution of opinion is taking place among anthropologists and historians as well to-day, similar to that which was stimulated in geology many years ago by Sir Charles Lyell. That is to say, conceptions of terrific cataclysms, human or geological, producing great results suddenly, are being supplanted by theories of slow-moving causes, working about us to-day, which, acting constantly, almost imperceptibly, in the aggregate are no less mighty in their results. In pursuance of this change of view, students look to-day to present social slow-working movements for the main explanation of the great racial migrations in the past.

We can not resist the conclusion that the Teutonic expansion must be ascribed in part to the relative infertility of the north of Europe; possibly to differences in birth rates, and the like. Population outran the means of support. For a long while its overflow was dammed back by the Roman Empire, until it finally broke over all barriers. It is conceivable that some such contrast as is now apparent between the French and Germans may have been operative then. The Germans are to-day constantly immigrating into northern France—all over the world, in fact—and why? Simply because population is increasing very rapidly; while in France it is practically at a standstill. Another effective force in inducing emigration from the north may have been differences in social customs indirectly due to environmental influences. Thus Baring-Gould has called attention to the contrasts in customs of inheritance which once obtained between the peasants of northern and southern

* The whole extent of the Roman wall in Germany is shown upon our subsequent map of village types, by means of a similar heavy black line. Its relation there to the Germanic village type can not fail to be observed.

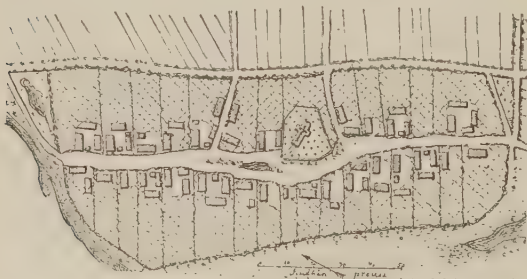
Germany. In the sandy, infertile Baltic plain the land is held in severalty, inheritance taking place in the direct line. The oldest son, sometimes the youngest, remains on the patrimony, while all the other children go forth into the world to make their way alone. Primogeniture prevails, in short. In the fertile parts of Würtemberg, on the other hand, where the village community long persisted, all the children share alike on the death of the father. Each one is a constituent element in the agrarian social body, for which reason no emigration of the younger generation takes place. The underlying reason for this difference may have been that in the north the soil was already saturated with population, so to speak. The farms were too poor to support more than a single family, a condition absent in the south. The net result of such varying customs after a few generations would be to induce a constant Teutonic emigration. Military expeditions may have been merely its superficial manifestation. It would, of course, be unwarranted to suggest that any one of these factors alone could cause the great historic expansion. Nevertheless, it is far from improbable that they were contributory in some degree.

When all the Teutonic tribes broke over bounds and went campaigning and colonizing in Gaul and the Roman Empire, a second great racial wave swept over Germany from the east. Perhaps the Huns and other Asiatic savages may have started it; at all events, the Slavic hordes all over the northeast began to move. Here we have another case of a widespread social phenomenon, military on the surface, but involving too many people to be limited to such forcible occupation. There is abundant evidence that these Slavs did not always drive out the earlier population. They often merely filled up the waste lands, more or less peaceably, thus infiltrating through the whole country without necessarily involving bloodshed.

There are several ways in which we may trace the extent of this Slavic invasion before we seek to apply our criteria of physical characteristics. Historically, we know that the Slavs were finally checked by Karl the Great, in the ninth century, at the so-called *Limes Sorabicus*. This fortified frontier is shown on our map on page 66, bounding the area ruled in large squares diagonally. The Slavic settlements may also be traced by means of place names. Those ending in *itz* are very common in Saxony; *zig* also, as in Leipzig; *a* in Jena; *dam* in Potsdam—all these cities were named by Slavs. Indications of this kind abound, showing that the immigrant hordes penetrated almost to the Rhine.

It seems impossible that the movements of a people should be traced merely by the study of the way in which they laid out their vil-

lages; yet August Meitzen, the eminent statistician, has just issued a great four-volume work, in which this has been done with conspicuous success.* It appears that the Slavic peoples in allotting land almost



SLAVIC LONG VILLAGE. Trebnitz, Prussian Saxony.

always followed either one of two plans. Sometimes they disposed the houses regularly along a single straight street, the church near the center, with small rectangular plots of garden behind each dwelling.

Outside this all land was held in common. Such a village was that of Trebnitz, whose ground plan is shown in our first cut on this page. In other cases it was customary to lay out the settlement in a circular form, constituting what is known as the Slavic round village. In such case there is but one opening to the common in the center, and the holdings in severalty extend outward in triangular sectors. Beyond these, in turn, lie the common pasture and woodlands. Our second diagram represents one of these village types. Contrast either of these simple and systematic settlements with the one plotted in our third map. This



SLAVIC ROUND VILLAGE. Witzeetze, Hanover.

Germanic village is utterly irregular. The houses face in every direction, and streets and lanes cross and recross in delightfully haphazard fashion. Nor is the agrarian organization of this Germanic

* *Siedelung und Agrarwesen der Westgermanen und Ostgermanen, der Kelten, Römer, Finnen und Slawen*, Berlin, 1895. Other papers on the same subject are given in our Bibliography.

village by any means simple. Divided into small plots or "hides," so called, a certain number of each kind are, or were once, assigned by lot in rotation to the heads of households. These "hides" were scattered all about the village, so that a peasant might be cultivating twenty or more parcels of land at one time. The organization was highly complex, including ordinances as to the kind of crops to be raised, and other similar matters of detail. We shall not attempt even to outline such a "Hufenverfassung"; for us it must suffice to note the complexity of the type, as opposed to the Slavic form.



GERMANIC VILLAGE. Geusa, Prussian Saxony.

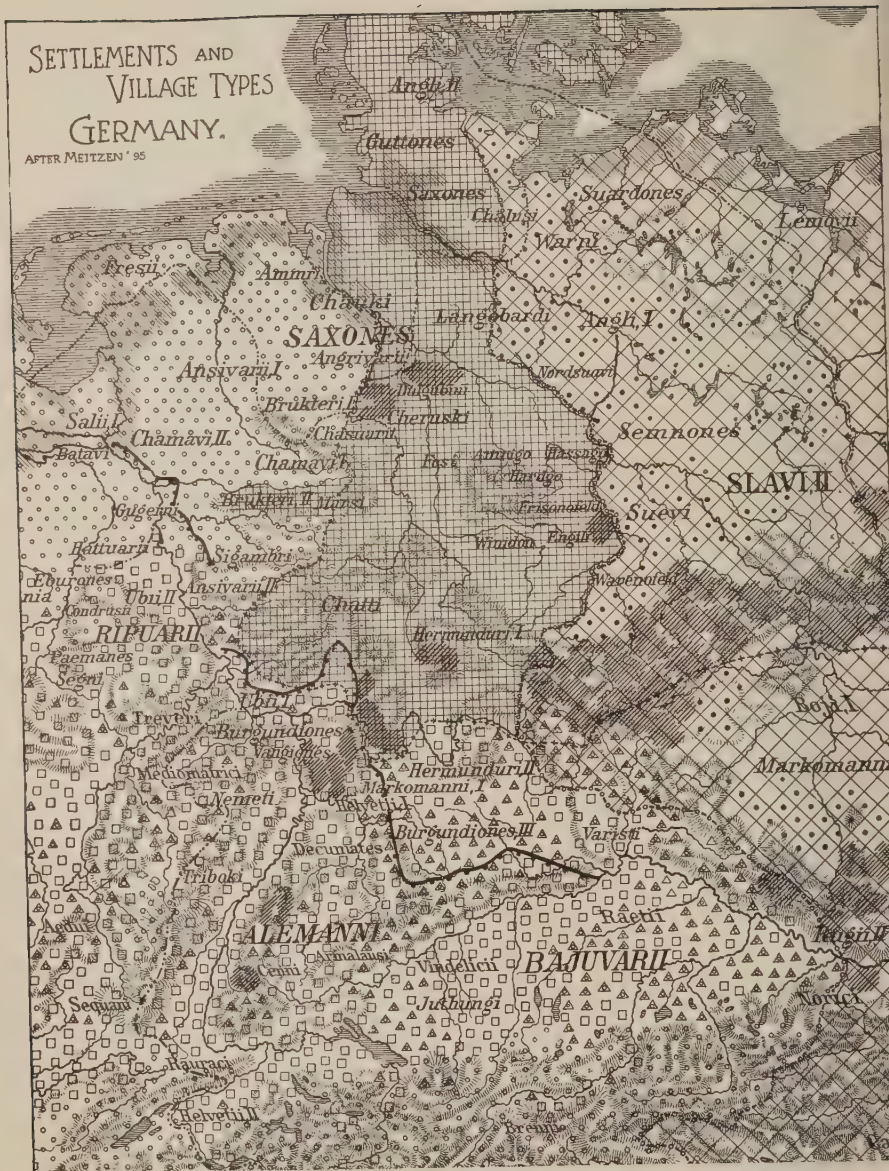
Our map, close at hand, shows the geographical distribution of these several village types. The circumscribed area of the original Germanic settlements is rather remarkable. It shows how far the Slavs penetrated in number sufficient thus to transform the landscape. It will be observed that on this map the small squares and triangles denote the areas into which the German tribes transplanted their peculiar institutions. That they were temporarily held in check by the Romans appears from the correspondence between the Roman wall, shown by a heavy black line on the map, and the southern boundary of the Germanic villages. Of course, when they spread abroad, a considerable change in the agrarian organization was induced by the fact that the emigrants went as a conquering class. The institutions became less democratic, rather approaching the feudal or manorial type; but they all preserved sufficient peculiarities to manifest their origin. Such hybrid village types, covering all northern France and eastern England, are as good proof of Teutonization as we could ask.*

It will be observed that all the village types we have so far illustrated are closely concentrated and compact. A remarkably sudden change in this respect takes place west of the original Germanic

* *Vide* map in Meitzen's Atlas to volume iii of his great work, Anlage 66a.

SETTLEMENTS AND VILLAGE TYPES GERMANY.

AFTER MEITZEN '95



PURE GERMAN

CELTIC HOUSE

SLAVIC

GERMAN VILLAGE

CONQUESTS
AFTER CAESAR'S TIME

MANOR TYPE

ROUND VILLAGES

village area. The whole economic character of the country changes within a few miles. It is of great historic importance. Our map shows the transition to occur strictly along the course of the Weser River. A large district is here occupied by the Celtic house, so called. The small circles denote that there are no closely built villages at all in the region so marked. Each house stands entirely by itself, in the middle of its farm, generally in no definite relation to the highroads. These latter connect market places and churches perhaps, about which are sometimes dwellings for the schoolmaster, the minister, or storekeeper; but the peasantry, the agricultural population, is scattered entirely broadcast. This resembles the distribution of our American farmers' dwellings in the Western States. We have no time to discuss the origin of these peculiarities. The opinion prevails that they stand in some relation to the clan organization of the Kelts, who are said to have once occupied this territory. The nearest prototype is, as our map shows, in the high Alps.

It is high time to take up once more the main thread of our argument—how far did the Slavic invasion, which so profoundly influenced the agrarian institutions, affect the physical type of the people of Germany? We may subdivide the Slavic-speaking nations of eastern Europe into two groups, which, however, differ from one another and from the pure Alpine race only in degree.* The northern Slavs include the Russians, Poles, Slovaks, Czechs, and Wends; the southern is composed of the Serbs, Croats, Slovenes, and Albanians. Both of these are broad-headed, the southern group being rather taller and considerably darker than the one which surrounds Germany. All the modern Slavic peoples of northern Europe approximate to the Alpine type; from which it follows that intermixture of them with the Teutons ought normally to produce shorter stature, darker hair and eyes, and, most persistently of all, an increased breadth of head. The district where these changes have been most clearly induced is in the region of Saxony, especially about Halle. A noticeable contrast is apparent between this district and the protected hills of Thuringia. The peasants in the plain of the Saale are appreciably shorter in stature and broader-headed than their neighbors. This Slavic invasion penetrated Bavaria from the northeast, the intruders apparently taking possession of the upland districts, which had been thinly peopled before. So well marked was this that the region south of Baireuth was long known as Slavonia. In places, as at Regensburg and Berlin, we may trace the Slavic intrusion

* The great authority upon this part of Europe is Dr. A. Weisbach, a full list of whose papers is given in our Bibliography of the Ethnology of Europe.

in the different strata of crania in the burial places. The general extent of this Slavonization of Germany is indicated upon our large double-page map of brunette types. The wedge of color which seems to follow down the Oder and over nearly to Holstein is undoubtedly of such origin. Because of this historic movement Saxony, Brandenburg, and Mecklenburg are less purely Teutonic than they once were in respect of pigmentation. The whole east is, as we have already seen, broader-headed, shading off imperceptibly into the countries where pure Slavic languages are in daily use. Thus the contrast in customs and traditions between the eastern and western Germans, which historians since Cæsar have commented upon, seems to have an ethnic basis of fact upon which to rest.

We have now studied the Teutons at home and in their wanderings on the mainland. In our next article we shall see how profoundly they have modified the ethnic complexion of the British Isles. Then we shall be prepared to see how much truth there is in the theory, boldly proclaimed as a proved fact, that they were the original Aryan inventors of European civilization, as well as the chosen agents for its dissemination.

BURS AND BEGGAR'S-TICKS.

By SPENCER TROTTER,

PROFESSOR OF BIOLOGY IN SWARTHMORE COLLEGE, PENNSYLVANIA.

MY setter comes out of the underwoods, after one of his incur-sive rambles, garnished with strings of green "stickers" and with harsh, brown burs clinging tenaciously to the long, feathery hairs of his tail and about his legs and ears. I have kept in the narrow path to avoid these pests of the autumn woods only to find that they have laid fast hold upon my clothes when by some unwitting step I brushed against the border tangle. In picking them off I notice their curious forms and the fact that they are not all alike. Here are some slender darts that seem to hold by barbed heads; there a row of flattened pods clinging by their whole surface; while numberless tiny brown burs are gathered in groups or scattered promiscuously about trouser legs and coat skirt.

It is strange how an interest is suddenly awakened about the most commonplace objects in life. We move for years among old, familiar things without giving them a passing thought, when all at once some subtle spell is cast about them, and they become vested with a charming interest. I have tramped many times through autumn woods and picked off the "stickers" with no good will, but to-day they strike

me as more than "stickers." I have discovered an old friend among them. Withered and brown, I should scarcely have recognized the friend of my springtime rambles but for a certain odor of the roots and a sprig of young green leaves by the side of the old, dry stalk. It all comes back now—sweet cicely of the spring woods with its umbels of white blossoms and that sweet, aniselike smell of its roots. To discover an old friend in a strange guise is enough in itself to whet one's interest, and I have curiosity to know how sweet cicely fares in the undertime of the year. All through the woods I find the dry, leafless stalks of the plant adorned with slender, black seed-pods that cling in pairs to the delicate pedicels of the umbel clusters. Under a magnifying lens each pod reveals a structure of wonderful design, the sole purpose of which is to fasten on to any object that may brush past. To this intent it is furnished with delicate hooks, arranged in parallel lines along its sides, lying close against the pod and pointing back from its free end. The free end of the pod tapers into a slender style armed with the same hooklike structures, so that whatever part is touched it will be sure to cling fast.

Another umbelwort, the fruit of which catches on to the clothes in our autumn woodland walks, is sanicle or black snakeroot. We

come upon it in the undergrowth of hillsides and in the dry woods of the uplands with its small, brown burs bunched in clusters on the ends of the branching stem. It grows scarcely higher than one's knees, and in the tangled mass of brown and green is often passed unnoticed. Each little bur presents an array of minute hooked bristles, set closely together, and forming a most effective means for attachment to the hairy covering of animals.

The various species of *Desmodium*, or tick trefoil of the pulse tribe, are among the most persistent "stickers" of the October woods. The flattened, several-lobed pods are more familiar to us as clinging in detached lobes to our clothes after coming out of the



woods than when hanging from the branching tops of the slender, wandlike plants. It is seldom that a complete pod is found, for the deeply cut joints of the one-seeded lobes need only a gentle pull to break them. The lobes have a raspy feel, and a pocket lens shows their flat sides to be thickly covered with minute, curling hairs, and few "stickers" are harder to pull off than those of the *desmodiums*, since they cling closely by their whole surface to any woolly substance.

A group of "stickers" that frequently adorn the wanderer through autumn woods are those of the bedstraw or cleavers of the genus *Galium*. In some of the species the low, trailing stems and



their leafy branches are roughened with small, hooked bristles, while in others, as in the common cleavers, or robin-run-the-hedge, the fruit also is thus armed and adhesive. *Circæa*, the enchant-er's nightshade, that grows so abundantly in the depths of cool, moist woods, contributes a large share to the motley collection of "stickers," its small, burlike fruit being covered with tiny, hooked prickles. So in the species of comfrey, or hound's tongue, the nutlets are rough-coated with an armament of short barbs and hooks that fasten themselves to the wool and hair, and are very troublesome to sheep that stray into the copses along the pasture side. The fruit of one species, familiarly known as "beggar's lice," is one of the most an-

noying pests of the woods, and Gray, at the end of his technical description of the plant, calls it "a common and vile weed."

Among the *Compositæ* there are comparatively few plants which effect their dispersal in this parasitlike way, most of the forms developing the characteristic downy structures known as pappus, like the dandelion and the thistle, that float their seeds away on the wings of the wind. Some species, however, like the bur-marigolds, have fallen into the parasitic mode of dispersal, and these are mostly plants of the low, tangled thickets along streams and in swampy places. The many-flowered heads of the bur-marigold ripen in the

fall into numerous flattened seedlike bodies, or achenia, each one of which is crowned with two or more stiff, needlelike, and barbed awns. Few "stickers" are more annoying than these "beggar's-ticks" of the bur-marigold. There is not a patch of low tangle that is not full of them, and one can scarcely pass by such places without bearing away a closely clinging horde of the pests. In the drier woods of the uplands a familiar species of bur-marigold is abundant, with longer and more slender achenia, which are known as

"Spanish needles."

Among the larger burs that gather on us in the fall are those of two composite plants—the burdock and the cocklebur. They are both weeds of waste places, coarse and ill-looking, springing up in rank abundance about pigpens, barnyard fences, and the dump heaps of open lots. The redeeming virtue of the burdock is its purple flower heads crowning the bristly green involucre, which in childhood days were plucked to make "buz-baskets." The larger and coarser cocklebur, with its



armament of strong hooks, is another of Dr. Gray's "vile weeds," wrapping itself inextricably among the hair and wool of the dog or sheep that unwittingly strays into its domain.

The fruit is the vehicle of the seed, and in each seed lies hidden the germ of a new plant. To spread itself as far and wide over the earth as its environing conditions will allow is the aim of every plant. In some the fruit has developed into an edible berry, and the hard-coated seeds pass uninjured through the bodies of animals, and are scattered long distances away from the parent plants. In many forms it is fashioned for sailing in air currents; in some, like the cocoanut, with its tough, buoyant husk, to be floated on the waves and washed by the tides and ocean currents to distant shores. Every plant tends to hold back this dispersive effort until its seeds

have matured. As this is accomplished the ovary ripens into the fruit, of a form and fashion after its kind. The green color, that served to protect it when ripening amid the mass of foliage, changes to the conspicuous reds and yellows that catch the eye of a wandering animal—and so its part is played. Among these burs and “stickers” of our autumn woodlands we see but another means for securing this end. The wandering deer or bear, the hunter following its trail through the undergrowth, the fox, skunk, raccoon, and such lesser wood folk, each serves a turn in bearing away these bristly fruits. How well it has been accomplished is seen in the



wide dispersal of these plants. A striking fact in evidence of this is the relatively large number that have come from the shores of Europe as uninvited guests. *Circæa*, the burdock, cocklebur, several species of cleavers, and a species of comfrey have thus become naturalized in our country, and it is not improbable that several of our native species have found their way to the Old World by catching fast to some passing vagrant, who later took ship and landed with the burs still clinging to his clothes.

Reproduction and dispersal are the two great aims in the life of every plant and animal. All else is but the means, the mere contrivances to gain the best advantage in the accomplishment of these

ultimate efforts. Every species, every individual exists by virtue of having striven to attain these ends. In the structure of each one is the record of the attainment, partial or complete, as the case may be. And each man and woman of us is toiling in his or her way toward the same goal, unconscious of that something within us, greater than ourselves, that "guides us, blindfold but safe, from one age on to another." The burs and "stickers" that cling so persistently to our clothes are but a part of the same great effort. It is the only way sweet cicely, desmodium, the bur-marigold, and their kin have of traveling through the woods, and so on from forest to forest, from swamp tangle to swamp tangle. They live their lives as truly as a man lives his, with equally as good a purpose that is equally as well attained. Each embodies those essential qualities of living that the great teacher discerned when he bade men "consider the lilies of the field."

EXPERT TESTIMONY IN THE BERING-SEA CONTROVERSY.

BY PROF. T. C. MENDENHALL.

THE intelligent public, fickle and uncertain as it is, has apparently not entirely withdrawn its interest from one of the most important and suggestive of modern diplomatic entanglements, the Bering-Sea controversy. Although thought to have been finally settled by arbitration in 1893, the Paris award seems to constitute only the beginning of a new phase of the subject. The valuable investigations and interesting reports of the last American commissioner, Dr. Jordan, and of his English colleague have seemed to keep the matter alive in the public mind, and to the interested and informed reader they have furnished a fresh example of that curious tendency among scientific experts to come to conclusions diametrically opposed to each other, although starting with essentially the same data. Of course, everybody knows that it is essential to the proper carrying on of a scientific investigation that it be commenced with no preconceived notions as to how it is coming out, and that judgment should wait on fact, ever ready to incline this way or that, in obedience to the compelling laws of thought. Justice to the man of science obliges the admission that, take him in his laboratory or library, with no end in view except that of getting at the truth, he generally lives fairly well up to this high standard, and easily, too. But transform him by the magic influence of a handsome retainer, or any other like incentive, into a *scientific expert*, and he is a horse of another color. He must now assume a certain theory to be true,

and use his experience and skill to convince others that the assumption is sound; he must also be able to discredit and put to shame another scientific expert who is doing the same thing for the other side. This is not an overstrong statement as applied to the greater portion of modern scientific expert work as utilized in legal controversy. Generally one and often both sides in such a controversy will hope to avoid a full exposition of fact or a clear presentation of the whole truth; and just as the able lawyer receives emoluments far beyond those of the abler judge, the expert witness who can prove his case is made much more comfortable in this world than one who sees all sides and no side, but only the truth. Men of science must not be held entirely responsible for this condition of things, however, for they have long and strenuously urged a change in the system to which it is due. Nor must it be assumed that any special moral obliquity exists in such cases, for always and everywhere judgment is unconsciously influenced by personal interests.

It has not often happened that men trained to scientific methods of investigation and modes of thought have been called upon, on that account, to take part in diplomatic negotiations. Indeed, there is at first blush something ill-fitting about such an arrangement, for the word "diplomacy" in theory and in practice, as well as in the dictionary, stands for a certain "dexterity or skill in securing advantages," for which there is no real use in science.

The dispute with Great Britain over the Alaskan seal herd has given opportunity for the utilization of scientific training and expert knowledge in the determination of the fundamental facts and conditions upon which the whole question should turn. The conclusions regarding these facts and conditions which have been reached by the several investigating commissions appointed by the two great powers involved are so different and so directly opposed to each other that a review of the work of one of them ought to be of general as well as special interest.

For this purpose it is not necessary to present a historical narrative of the origin and growth of the sealing industry at the Pribilof Islands under the direction first of Russia, and since 1867 of the United States; nor to trace the beginnings of the international dispute concerning the right to control the taking of seals from the water, either in Bering Sea or in the North Pacific Ocean. It is well known that after the Executive of the United States Government, supported by Congress, had for several years assumed the right to prevent pelagic sealing in Bering Sea, vigorous protest was made by Great Britain, and that there resulted the agreement upon the *modus vivendi* of 1891, and the concurrence on the part of the United States in the proposal of the British Government for "a

reference to a joint commission to ascertain what permanent measures are necessary for the preservation of the fur-seal species in the northern Pacific Ocean." The provisions of the treaty referring to this commission were as follows:

"Each Government shall appoint two commissioners to investigate conjointly with the commissioners of the other Government all the facts relating to seal life in Bering Sea, and the measures necessary for its proper protection and preservation. The four commissioners shall, so far as they may be able to agree, make a joint report to each of the two Governments, and they shall also report, either jointly or severally, to each Government on any points upon which they may be unable to agree."

On June 24, 1891, Sir George Baden-Powell, M. P., and Dr. George M. Dawson were appointed as commissioners for Great Britain, and on July 10th Dr. C. Hart Merriam and the writer of this article were designated to serve the United States in a like capacity.

It will be seen above that the duty of these commissioners was primarily the ascertainment of facts, together with the recommendation of such measures as in their judgment were necessary for proper protection and preservation of seal life in Bering Sea and the northern Pacific Ocean. It is important to note, also, that in the letter of instructions of the respective powers to their commissioners this was emphasized as the "main object of the inquiry." In the letter of Lord Salisbury to the British commissioners they are instructed that their principal duty will be to ascertain "what international arrangements, if any, are necessary between Great Britain and the United States, and Russia or any other power, for the purpose of preserving the fur-seal race in Bering Sea from extermination." He further says: "I need scarcely remind you that your investigation should be carried on with strict impartiality, that you should neglect no sources of information which may be likely to assist you in arriving at a sound conclusion, and that great care should be taken to sift the evidence that is brought before you."

"It is equally to the interest of all the Governments concerned in the sealing industry that it should be protected from all serious risk of extinction in consequence of the use of wasteful and injudicious methods."

It will be remembered that the correspondence relative to the joint commission was concurrent with that in which the proposed arbitration treaty was discussed; and, indeed, it was only on the signing of that treaty that the commissioners were to become endowed with full authority for joint consideration and report.

The American commissioners were especially instructed by the

Secretary of State that with questions relating to the exercise of exclusive jurisdiction by the United States for the protection of seals they had nothing to do, and that they were "not authorized to consider or discuss them." Their function was especially restricted to the consideration of facts, causes, and remedies as suggested in the treaty quoted above.

It thus appears to have been clearly the intention of both Governments to regard the commission as one organized purely for the ascertainment of facts and the recommendation of such remedies and regulations as would be suggested by the facts. There is no assumption of any diversity of interests in the matter; the problem is submitted to the commissioners as it might have been if the whole affair had concerned the United States alone, or Great Britain alone. Certain methods of taking seals, at sea and on shore, are followed; it is claimed that these methods, one or both, or other causes are accomplishing the extermination of the herd; the commission is to investigate all the facts, and if it concludes that the herd is in danger of extermination it is to suggest such regulations as it may agree upon for its preservation—not a word or a hint about national or international or traditional rights or "compensatory provisions."

It is of the utmost importance to note these facts, as they appear in the letters of instruction to the commissioners, for they are the basis of the assertion, which might as well be made now as later, that the American commissioners alone, and from the beginning, considered the subject from a scientific or judicial standpoint, while their colleagues, also from the beginning, treated the problem as if it were diplomatic in character, not omitting an occasional attempt to use "dexterity and skill in securing advantages." A small part of the evidence available will suffice to make good this possibly extreme statement, and in attempting to do so it must be understood that not the slightest reflection upon the distinguished gentlemen, who so ably represented and maintained what they believed to be the best interests of the British Government, is intended, or criticism of the course which they followed during the conferences; it is only meant to draw attention to the fact that they were in the attitude of the expert witness whose vision and judgment are undeniably, though unconsciously, influenced by the necessary demands of a previously accepted hypothesis. It is extremely likely that they have precisely this view of their American colleagues, and it is with a view to a fair adjudication of this question that the facts are herewith submitted.

To begin with, there was necessarily a difference in the state of mind of the two commissions in approaching the problem, due to the fact that the British commissioners had already made public ex-

pression of their views upon the subject, in which they made positive declarations of opinions already formed upon nearly, if not quite, all questions at issue, and this before they were even appointed as commissioners. This fact was made the subject of a note by Mr. Blaine to the British minister, on February 6, 1892, and was discussed in a reply by Sir Julian Pauncefote. On the other hand, the American commissioners had taken no part in the current discussion, and, as a matter of fact, had been for several months prior to their appointment engaged in professional work in regions of the country remote from newspapers or telegraphs, and were entirely ignorant of the remarkable wave of public excitement and anxiety by which the country had been swept in consequence of the rather stirring diplomatic correspondence which had been going on. Without returning to Washington, or in any way coming in touch with the generally prevailing irritation due to the attitude of Great Britain, they proceeded to Bering Sea and the Pribilof Islands, having only in mind that they were charged to investigate "the facts having relation to seal life in Bering Sea, and the measures necessary for its proper protection and preservation." They were accompanied in their investigations by the British commissioners, to whom every facility for a thorough study of the situation was accorded. Rookeries were visited together, abandoned beaches were examined in their company, and as far as could be all data from which conclusions might be drawn were made the common property of both commissions. The evidence of great diminution in the number of the seals herding upon the islands seemed to be overwhelming, and much of it, especially the physical condition of the rookeries themselves, was quite independent of human testimony; natives and Government officers who had resided on the islands for many years were practically unanimous in their opinion that the herd was being destroyed. The attention of the British commissioners was called to the unmistakable evidences of depopulated breeding rookeries and deserted hauling grounds, but there were early indications that they were looking for support for a hypothesis carried with them to the field of observation. After considerable "joint and several" investigation, the commissioners separated, to meet again in conference for the preparation of a report early in the year 1892.

It is not necessary to enter into the details of the extensive observations and studies which led the American commissioners to conclude, first, that the number of seals was rapidly diminishing; second, that the principal cause of this diminution was and had been pelagic sealing; third, that the only effective remedy was the complete cessation of taking seals at sea. Their report, published as a part of the case of the United States, may be referred to by those who wish to

know more thoroughly the situation as it presented itself six years ago. It is a satisfaction to know that every assumption which they made has been justified, and every prophecy in which they indulged has been fulfilled by subsequent events.

From the beginning they sought to have the conference at Washington conducted upon the assumption that all political or international questions, rights, or privileges should be ignored; that facts should first be determined, causes got at as far as possible, and remedies proposed, as if an individual were the sole arbiter of the question, and the benefit of the whole people only considered. In fact, at one stage of the conference the following question was submitted as a possible means of clearing the way to what seemed to the Americans to be the real function of the joint commission: "Suppose that one individual controlled the whole matter of killing seals on the Pribilof Islands, in Bering Sea, in the North Pacific, and wherever any of this herd of fur seals are found during their entire life, and suppose that the end in view was to so conduct the killing that the largest possible number of commercially valuable skins could be obtained every year perpetually—that is to say, that the owner or controller would be forever benefited in the highest degree by the existence of the herd; under these conditions, what would be the best method of killing—by hunting at sea under the most perfect and complete regulations and restrictions that are possible, or by killing males only on land under the most perfect and complete regulations and restrictions that are possible?"

But from the start it was evident that the British commissioners were determined to discuss and consider all questions from a diplomatic and political standpoint. There was to be difficulty in agreeing upon conditions; greater difficulty in determining causes; and practical disagreement as to remedies. At the very first conference strong objection was urged against a part of the letter of instructions which the Secretary of State had communicated to the American commissioners, and which they, in turn, communicated to their British colleagues, receiving in exchange the instructions sent by Lord Salisbury. The obnoxious paragraph was that in which the American commissioners are informed that they need not concern themselves with the question of "the exercise of complete jurisdiction by the United States for the protection of seals," it being declared that this made it impossible to consider matters relating to the manner of taking seals upon the Pribilof Islands. This assumed obstacle to a full discussion of the problem threatened to interrupt and delay the conferences, notwithstanding the repeated declaration of the Americans that it did not exist, and it became necessary to suggest that there seemed no occasion for concern on the part of the

British commissioners on account of the character of instructions received by their American colleagues, at least not until the latter declined on account of such instructions to consider any question at all related to the work of the commission. The incident is referred to only as one of many evidences of a tendency to avoid the simple line of scientific inquiry upon which it had been hoped the commission might work; and, further, that it may be recorded that throughout the entire life of the commission the representatives of the United States were absolutely free and unhampered in the exercise of their personal judgment, not only as to the scope of their powers but as well as to the attitude which they assumed on any question coming before them.

A preliminary basis of agreement had been prepared and was submitted by the Americans at the first conference. Its first proposition was a simple declaration of the decadence of seal life in Bering Sea. It had hardly been suspected that there could be serious difference of opinion on this point, but there was an unwillingness to go on record as believing that the herd was greatly declining in numbers, except in the most guarded manner. It was even affirmed by the British commissioners that there was evidence to show that the number found on the islands in the season of 1891 was greater than in 1890.

The second proposition submitted was a declaration that this decrease in the number of seals frequenting the Pribilof Islands must be attributed largely, if not wholly, to pelagic sealing. This involved the gist of the whole controversy, and in support of it the American commissioners offered the now well-known facts regarding the natural history of the seal, the inevitable results of sealing at sea, the impossibility of perfect control of land killing, the silent but unimpeachable testimony of skins marketed by pelagic sealers, and other evidence, the strength of which time has served only to increase. There were certain facts of profound significance as affecting this question which it seemed impossible to controvert. An animal whose period of gestation is about one year, and which gives birth to but a single individual, belongs to a species not likely to multiply with great rapidity, even when left to contend only with its natural enemies. Add to this the admitted facts that the two sexes are equal in number at birth, and that polygamy is universal, only one male being found on the breeding rookeries for every fifteen or twenty females, and it follows with a certainty rarely met with in discussions of this kind that the preservation of the herd depends upon the preservation of the female, and that a very large proportion of males may be taken annually without affecting in any way the number born. Had a good set of "mortality tables" for seals ex-

isted, such as have long been available for men, it would have been easy to calculate just what number of males of fixed ages might be killed annually without interference with the reproductive power of the herd, and computations of this character were made and submitted by the American commissioners, based upon the best available data, showing that the average number taken upon the Pribilof Islands during the past twenty years could not have been greatly in excess of safety.

But in sealing at sea discrimination as to sex is impossible. It was affirmed that by far the greater number of seals killed at sea were females, an assumption justified by an examination of the skins of a large number of seals taken from the water, as well as by other evidence not less conclusive, though more circumstantial. Indeed, the British commissioners admitted that at least one half of those killed at sea were females, making it extremely difficult to understand how they could argue themselves into the belief that the herd could ever reach its maximum dimensions while pelagic sealing existed, or why the growth of the latter would not necessarily lead to its practical extermination. Finally, it was submitted that if the truth of these two propositions was agreed upon it was impossible to avoid the following conclusions: That the restoration of the sealing industry to its normal condition, so far as relates to the Pribilof Islands, requires the entire cessation of killing, both on the islands and at sea, for a period of years not less than five, and to be extended if competent examination of the rookeries so indicated. When killing was resumed it should be restricted to selective killing on land, under the most rigid inspection, and pelagic sealing should be perpetually prohibited.

In submitting these propositions as the logical outcome of the facts as determined, the American commissioners were adhering to both the letter and spirit of the convention, in which they were directed to investigate and report upon "the measures necessary for the proper protection and preservation" of seal life. They did not believe it to be their duty to consider how such measures would affect the interests, business or political, of the subjects of either or any nation. They believed with Lord Salisbury that it was "equally to the interests of all the Governments concerned in the sealing industry that it should be protected from serious risks of extinction," and that the discussion of compensatory measures, equivalent adjustments, methods of enforcement, etc., was not the duty of a commission organized to ascertain facts and conditions, determine causes, and suggest remedies. They also fully realized that they were tolerably certain to be thought ingenious rather than ingenuous, because the remedies which they suggested were apparently

and perhaps in the end really in the interests of the country they represented, although, in their judgment, in the end equally in the interests of the great nation represented by their colleagues.

A lengthy discussion followed this presentation, filling much of the time of the seventeen sessions of the conference, which extended through February and a part of the first week in March, 1892. The British commissioners were unwilling to admit that pelagic sealing was the main or even a principal cause of the diminution of seal life, for which they argued that killing on the islands was most largely responsible. It was even asserted that if taking on the islands was entirely discontinued all the pelagic sealing that could or ever would be carried on in Bering Sea and the North Pacific would never lead to the commercial extinction of the seal herd. Such an assertion made necessary others of an equally extraordinary character, such as that the killing of females at sea to the extent of furnishing one half of the pelagic catch, as they were compelled to admit, should be considered as a desirable and wholesome treatment of the herd, not tending in any way to reduce the total available product. They affirmed that the percentage of seals lost in pelagic sealing was very small, being much less than that by improper killing on the islands. They accounted for the very large excess of skins of females in the pelagic catch by declaring that during the past few years frequent raids upon the islands had been made, in which crews of sealing vessels descended upon the breeding rookeries at night and captured the females in large numbers. The small size of the islands and the presence of numerous guards near the principal rookeries rendered such an assumption practically impossible, and, although occasional raids have occurred, the poachers have always preferred the hauling grounds of the male seals, whose skins are more valuable than those of the females. It was generally believed by residents of the islands and Government inspectors that the number of skins obtained by this kind of poaching was extremely small. The presence of large numbers of dead "pups" or young seals, which was attributed by the American commissioners to starvation owing to the death of their mothers at the hands of pelagic sealers, was charged by the British commissioners to other causes, some form of disease or epidemic being the favorite.

Differences so radical as to causes were naturally accompanied by equally radical differences as to remedies. On the one hand, it was contended that as pelagic sealing was in the largest measure responsible for the evil, its entire suppression ought to be recommended; on the other, that pelagic sealing had comparatively little to do with it, and that severe restriction on the number killed on the islands, with perhaps a small closed area surrounding each, would

arrest any diminution in numbers and restore the herd to its normal condition. For an area of protection perpetually closed to pelagic sealing, the British commissioners suggested a zone about each island ten miles in width. When it is remembered that the two principal Pribilof Islands are each about a dozen miles long and nearly half as wide, and that they are approximately distant forty miles from each other, the utter inadequacy of such a suggestion is at once evident. To the consideration of a closed time during which *all* sealing at sea should be prohibited, they were not at all inclined, except it were so limited as to be practically valueless. They strongly urged the recommendation of a scheme in which it was assumed that some sort of a relation might be established between the number of seals permitted to be killed on the islands and the pelagic catch. This relation was to be elastic and compensatory, and its advocacy logically compelled the extraordinary declaration that sealing at sea could be as vigorously and exactly controlled and restricted as sealing on land.

In short, it became more and more evident every day, as the conferences continued, that the representatives of the people who were engaged in pelagic sealing were set upon opposing any recommendations looking either to its destruction or to its serious curtailment. Apparently the question was not so much *How will this measure or that affect the vitality of the seal herd?* as *How will it affect the profits of this nation or the losses of that?* The possible preservation or destruction of a useful and rare species was lost sight of in the consideration of immediate gains, compensatory regulations, equivalent shares, etc. The American commissioners, while not unwilling to discuss all proposals to limit and control sealing, both on land and at sea, became so thoroughly convinced that there was but one efficacious remedy that they felt compelled to reject all schemes of improvement in which that was not insisted upon. Indeed, nothing else was offered or considered which, in their judgment, gave even small encouragement of success in actual practice.

Under these circumstances it was only possible to agree to disagree. A very brief joint report was finally settled upon and drawn up, in which the only conclusion of any importance whatever was a most cautious and circumspect declaration that there had been a diminution in the number of seals annually resorting to the Pribilof Islands, and a hesitating admission that "man" must be held responsible for it.

It is worth noting that during the entire conference there was a singular anxiety and desire on the part of the British commissioners to secure from their American colleagues some formal admission regarding or recognition of pelagic sealing as a legitimate mode of

taking seals, and one not inconsistent with the continued preservation of the herd in normal extent. The several methods by which this was sought to be accomplished were striking illustrations of how far the work of the joint commission departed from the lines along which it was originally laid out, leaving the region of scientific investigation for that of partisanship and diplomacy.

As every one knows, the whole question with the joint and separate reports of the commissions went to arbitration before the tribunal at Paris in the summer of 1893. The report of the American commissioners was completed and submitted about the middle of April, 1892; that of their British colleagues was received by Lord Salisbury on August 14th. These dates are significant. In recent diplomatic correspondence relating to the present state of the controversy there has appeared a vigorous protest against a policy of delay in submitting reports which were to be simultaneous or concurrent, and it has been plainly intimated that advantages are expected to accrue from such delay. This is but history repeating itself. The strictures of Messrs. Phelps, Carter, Blodgett, and Coudert, counsel for the United States in 1893, upon the great and unjust advantage taken by the Government of Great Britain in this way might furnish useful, if not interesting, reading for some of the severer critics of the recent action of the Department of State.

The Bering-Sea arbitration, with its disastrous consequences to the sealing industry, can hardly be referred to with satisfaction by those who so earnestly desire the reference of all international disputes to similar tribunals. It serves, however, as an excellent illustration of the fact that international arbitration is now and must be for a long time little more than an elaborate and costly means of reaching a compromise. The Paris award gave to the United States somewhat more protection of seal life than Great Britain had offered through her commissioners, but vastly less than was asked as necessary and just. The British commissioners had suggested a protected zone about the islands of ten miles width, and were willing to consider a close season during that period in which pelagic sealing is unprofitable; the arbitration tribunal gave a zone of sixty miles and a close season of possible consequence, if only it could be enforced, together with a few minor restrictions which have proved to be of really little value. It is difficult to find a compromise between life and death, and even so dignified and learned a body as the Paris tribunal failed in this instance. The experience of three or four years has shown the signal failure of the remedies proposed. And this must not be attributed alone to the lack of perfect application of these remedies. The United States has maintained a fleet of Bering-Sea police at once efficient and expensive. Great Britain

has naturally done as little as could well be managed to aid in the enforcement of the arbitration decree, and indeed how could the most sanguine millenarian, with any knowledge of national history or traditions, imagine that the British navy would be spurred to great activity in running down schooners flying the British flag, manned by British subjects, while engaged in the profitable pursuit of an industry which another nation claims as its own?

During the past two years, under the efficient direction of Dr. Jordan, elaborate investigations, including something like an actual count, have been made to ascertain the number of seals frequenting the Pribilof Islands. Other studies have strengthened the conclusion that the number has greatly diminished within the past decade, and is now greatly and rapidly diminishing. In spite of the regulations of the Paris tribunal pelagic sealing has increased enormously, while legitimate killing upon the islands has been largely discontinued. That was a charming thrust of Lord Salisbury's when he said that the English interest in the fur-seal industry had for some years exceeded the American, for it is beginning to be apparent that while the Americans have busied themselves arranging for arbitrations, seeking international co-operation, and organizing scientific commissions to prove again what had been proved before, their sleepless adversaries were quietly gathering in the profits, realizing that the business must soon be closed up anyhow. In the report of 1892 the British commissioners had no intention of indulging in humor when they suggested as one of the most desirable measures the setting apart of at least *one* of the two seal islands entirely for the purpose of breeding seals for pelagic sealers, no land killing to be allowed there.

Is it not time for the people of the United States to ask whether the game is worth the candle? Two considerations call for the preservation of the Alaska seals, the sentimental and the commercial. The former may be dismissed, as it has been in cases of far more intimate contact between man and the species exterminated. The commercial consideration is one that ought not to be difficult to deal with. In fact, *all* are agreed that the "preservation" of the fur-seal species is important to mankind, and it is only necessary to determine *how* important or how large a proportion of mankind is deeply concerned in this. If the continued existence of any industry or material product is of extreme importance to the comfort, health, or general well-being of a large part of mankind, extreme measures may justly be resorted to to insure its permanence. It is not difficult to imagine conditions under which the care and preservation of the buffalo might have been forced upon the people of the United States, wisely and justly.

The first part of the argument of the American counsel before the Paris Arbitration Tribunal consisted of a most suggestive half-dozen pages, prepared by Mr. James C. Carter, in answer to the question, "What law is to govern the decision?" Mr. Carter declares that it must rest upon *international law*, which he defines as the "general standard of justice upon which civilized nations are agreed." This standard is fixed neither as to time nor place, and depends largely on the character of the interests involved. Existing as law without legislation, it controls and influences governments much as public opinion influences individuals. Indeed, international law may be considered as *the public opinion of nations*, and like other public opinion it may be depended upon to support extreme measures in extreme cases.

If the claim of the United States regarding the evil consequences of pelagic sealing are valid, and its absolute prohibition the only means of preventing the annihilation of the fur-seal species, the method of treatment adopted in 1886 and 1887—being, in fact, that followed by the Russian Government for many years—would be entirely justifiable, provided the value of the species to mankind was so great as to bring to such a policy the support of the public opinion of nations. It is now too late to discuss this question, however, for the nation is in honor bound to respect and abide by the Paris award, no matter how unreasonable and inadequate it may be. It is difficult to see what good will come from further discussions, investigations, or declarations. Until the regulations adopted at Paris are "abolished or modified by common agreement between the Governments of the United States and of Great Britain" they must stand.

Great Britain appears to be well satisfied with them, and ought to be if they have so affected legitimate sealing on the islands that "English interests in the fur-sealing industry now exceed American."

The heroic treatment resting on asserted exclusive jurisdiction and property rights, the basis of which was so strongly argued by Mr. Justice Harlan and Senator Morgan at Paris, is now estopped by the denial of such jurisdiction or rights in the decree of the tribunal appealed to. The artifice of branding female seals, which was to be resorted to extensively during the current season, will in no way diminish the number taken at sea, for the brand can be found only after the seal is killed, and it can not injure the skin enough to make the business unprofitable. Besides, it is an expedient hardly worthy the dignity of a great nation. Is it not the part of wisdom, then, to accept the situation? Already the cost of maintaining the struggle, the expense of commissions, policing fleets,

arbitrations, etc., has been enormous; on the other side of the account is the comparatively small tax on the few thousand skins taken on the islands since 1890, to say nothing of possible large payments of damages to the lessees for loss of profits on account of a forced diminution in the catch. With the present attitude of Great Britain, the practical extermination of the herd in the near future seems assured. The United States may have the pick of what remains by wholesale killing on the islands; further international irritation will be avoided, and an episode which has brought into strong relief certain national traits on both sides will close with at least one interesting result: it will be impossible to know absolutely which group of scientific experts was right in regard to the effects of pelagic sealing.

NATURAL AND ARTIFICIAL PERFUMES.

By M. JACQUES PASSY.

WE may divide the makers of perfumes into the two classes of those who furnish the raw materials for perfumery and the manufacturers proper. The former provide the essences, the pure or concentrated scents, and the latter mix and extend them, incorporate them into various liquids or pastes, and offer them for consumption. Another division, of recent occasion, may be made between those who extract natural perfumes according to the methods pursued for centuries and those who use chemical processes or make artificial perfumes; for, as dyestuffs are now composed from coal-tar products to the extent that some of the natural materials have been driven out by artificial substitutes, so a number of perfumes have been in like manner synthetized. But there is no probability that the synthesis of perfumes will ever be carried to the extent of which that of dyes seems capable, because, first, some essences are the raw material for the synthesis of artificial products of much greater value; and, secondly, the chemical problem of the synthesis of perfumes is more complicated than that which enters into the artificial production of coloring matters.

The preparation of natural essences is still a genuine agricultural industry. Flowers and leaves are the raw material, and they have to be treated fresh. The original laboratories are therefore generally established very near where the plants can enjoy the most favorable climatic conditions. Hence the crude essences generally come to us from various distant regions—essence of ilang from Manilla, of geranium from Réunion and Algeria, of lemon and citron from Ceylon and China, etc. But as the imported materials

are generally scandalously adulterated, European manufacturers have been impelled to bring home such of the crude material as will bear transportation. So sandalwood, cloves, patchouli leaves, and vetivert-grass roots brought dried and with their scents unimpaired are distilled in France and Germany rather than in the countries of their origin.

The most important center of this manufacture is the little city of Grasse, near Nice and Cannes, which, besides being a large center of production for the distillation of plants and woods, is the chief place where these special processes which have been transmitted through ages and are the only ones for the extraction of the perfumes of flowers are in use. The only chemical agents employed in these processes are vapor and fat.

The manufactories of artificial perfumes, on the other hand, are real laboratories of chemical products where the habitual agents of chemical industry are employed, requiring the intervention of chemists and engineers, and are established by preference at the great industrial centers. Hence good reasons exist for these two branches having been kept apart, although it is not certain that this separation will continue permanent.

The simplest process of extraction is by distillation. The flowers or leaves are put into the retorts with water and heated to the proper degree. The perfume passes over to the cooling apparatus with the vapor of the water and is condensed with it, after which it is separated from the water by taking advantage of the difference of density. The heat is applied by means of vapor under pressure. Formerly fire was applied directly, but the amount of production was insignificant compared with what it is now; this method is, however, still in use in small portable apparatus. Some distillations are literally performed on the spot, as those of certain aromatic plants which are not grown very near Grasse, the finer lavenders especially being found wild at considerable heights on the mountains. The communal lands up there are allotted every year, and extractors who make this a specialty establish themselves in their plots with their direct fire apparatus, expecting to dispose of their production to the large houses.

When the quantity produced is regarded, distillation is the most important branch of the perfumery industry. It is simple, inexpensive, requires but little manual labor, and is applicable to large quantities of material. But there are objections to it, and some of them are of so much force as to have led to the substitution for it of seemingly more primitive, and at all events more expensive, methods of extraction. The first objection is the liability of vapor, coming in contact with some of their more unstable constituents,

to change the character of some of the essences. A still more important objection is that the vapor may bring over some undesirable constituents existing in the plant, or by its action on some of the constituents may produce new substances in no way allied to the perfume. Impurities produced in this way communicate to the newly distilled essence what may be called the taste of the retort. Such inconveniences, of relatively little account in the coarse extracts, are very important in the more delicate distillations.

A process used at Grasse for conserving the more delicate qualities of the perfumes, and which constitutes a method original to the Maritime Alps, consists in the employment of grease for the composition of perfumed pomades. A grease of suitable consistence which will not become rancid is obtained by preparing a mixture of lard and beef fat and subjecting it to thorough refining processes. The perfume is incorporated with this base by a process of warm maceration, or by absorption.

For maceration the fat is melted in the marine bath and brought to a temperature of 60° or 70° C., as measured by the skill of the attendants rather than by the thermometer; the rose leaves, or whatever is to be treated, are introduced, thoroughly immersed; after a few hours the mixture is passed through strainers and drained, so as to separate the grease from the flowers as completely as possible. What grease remains on the rose leaves is washed off with warm water. The process is repeated with the same grease and with other flowers, and so goes on for fifteen or twenty days, according to the quality of the pomade that is desired. Some of this pomade is consumed as it stands; but by far the greater part is used for making extracts, or alcoholic infusions of the perfume. For this purpose the pomade is introduced with a suitable quantity of alcohol into a shaker, consisting of a cylinder in which a screw beater is kept going all the time. The mixture is thus actively beaten up, and, as the perfume has more affinity for the alcohol than for the grease, the grease in time becomes nearly inodorous, and the alcohol is charged with the greater part of the perfume. The grease is then sent to the soap maker, for it is not fit to be used again for a pomade.

The question may be asked, and has been asked, Why use the intervention of grease in the process of extraction? Why not apply alcohol or some substance of similar powers directly? Chemists have offered ether, sulphide of carbon, chloride of methyl, chloroform, and other scientifically prepared solvents, to have them rejected, and have blamed the manufacturers of Grasse for adhering to barbarous processes, and for their inability to escape their antiquated routine. A more scientific spirit would lead them to inquire

if there were not some reason for preferring grease. Most of the substitutes recommended have more liberal affinities than grease. Alcohol, for instance, unites readily with water, and with water takes substances held in solution by it, which are extremely undesirable in a perfume; and so with the other substances, according to their several properties. Grease has a narrow elective affinity, and takes just what is wanted and nothing else. Various petroleum substances have been proposed recently as extractors, and much may be said *prima facie* in favor of them; but experiments with them have not yet given satisfactory results.

In the process of absorption or *enfleurage* wooden frames furnished with glass bottoms are used. These, fitting closely together, are placed one upon another, so that a small inclosed space is left between every two of them, or a sort of greenhouse with glass above and below, inclosed with wood. The surfaces of the glasses are coated with grease, on which a layer of flowers is placed. The flowers are left there to shed their perfume, which is absorbed by the grease, for twenty-four hours, when they are removed and new flowers are put in their places. This is continued for two or three months, at the end of which time the pomade is ready for treatment as in the maceration process. The flowers to which this process is best adapted are the jasmine, tuberose, and mignonette. This *enfleurage* process has likewise drawn criticism, if not contempt, from men of science; and the question has been asked why a different treatment is given to these from that pursued with other flowers.

If we observe flowers with regard to their odors, we shall find that they may be divided into two categories: those which contain their perfume already formed, or have at least a considerable reserve of it, and those which have no reserve, but develop and emit their fragrance as they grow. When we rub roses or orange blossoms, for example—flowers of the former class—we perceive their fragrance very plainly. Such flowers may be treated by distillation, by the warm pomade process, or by extraction with volatile solvents, with results of a greater or less degree of perfection, but always positive; while if we rub a flower of jasmine, convallaria, or violet—which are of the second class—we perceive nothing but a slight pungent odor in the same plant which an instant before was exhaling a pervading fragrance. In crushing it we have killed it, and it produces no more perfume. Such flowers are not suitable for distillation or maceration or the action of volatile solvents, because there is nothing to be extracted from them.

The production and exhalation of odor go on while the plant continues to live and vegetate, even after it has been cut. When, therefore, it is placed in the limited atmosphere of these absorbing

cases, the perfume continues to be given out, and is absorbed by the grease. Contemplating the matter from this point of view, we are astonished at the sagacity of the perfume extractors of past ages, which enabled them to perceive that some flowers could be treated only by this absorption process, and to co-ordinate their operations so logically that the method could not have been better adapted to its purpose if it had been adjusted after a careful study of the physiological principles involved. Everything in the process seems adapted to the prolongation of the life of the flower. The close and consequently moist atmosphere in which it is placed preserves it against dying; the coolness of the apparatus prevents its wilting. The flowers of the tuberose are picked just as the bud is about to open. It blooms within the case, and gives out nearly all its perfume there.

We draw from these observations the two lessons that the extraction of natural perfumes is not, as is often believed, a question of pure chemistry, but is primarily one of vegetable physiology; and that in this domain, as in many others, practice is often in advance of theory. For my own part, I have never met with well-established processes sanctioned by long use which do not rest upon correct though frequently unconscious observations over which theory has nothing to boast.

As when people wanted to travel faster they devised the railroad instead of improving the stagecoach, so the achievements of chemistry in the domain of perfumes have not been made in building up the old industry, but through creating another. To enumerate and describe the artificial products now used in perfumery would be like composing a manual of chemistry. It will be of more interest to indicate a few categories of syntheses or chemical fabrications, and to point out the various chemical or financial questions they raise, illustrating them severally by typical examples described in detail.

There are several kinds of synthesis. One kind consists in isolating a natural principle, studying it, and trying to reproduce it. Such a synthesis may be called a methodical one, as following out a line traced from the beginning. Take, for example, the synthesis of ionone, or artificial violet. The authors of this synthesis, MM. Tiemann and Krüger, started with the natural perfume of iris root, which they found to be very characteristic and fixed. It was consequently considered to be a single very definite and stable substance. All these conditions were favorable. The preliminary researches of the authors showed that this substance existed in extremely weak proportions in iris powder. The proposed synthesis, therefore, promised to be lucrative; for, while all chemical syntheses are interesting, the probable financial bearing of the discovery is of consider-

able importance; and it is not the absolute cost but the probable profit that most deserves consideration. A primary characteristic of perfumes is their immense strength; a very minute quantity of one is sufficient to produce a large effect. Consequently, they may bear a large price without limiting consumption. But, to isolate this as yet unknown perfume, it was necessary to treat enormous quantities of iris powder, and this required industrial resources which the inventors could not command. These were secured by making suitable arrangements with two large houses which became parties in interest. The experiments lasted ten years. First, *irone*, the principle to which the odor of the violet is due, was isolated. A complete chemical study of it was made. Having remarked that citral, an aldehyde abundantly diffused in Nature, gave, on condensation with acetone, an acetone of the same crude formula as *irone*, these authors effected this condensation under the influence of hydrate of baryta. They thus obtained, as they had expected, an acetone of the same crude formula as *irone*—false *irone*; this, it is true, had neither the odor nor the properties of *irone*, but by the action of dilute sulphuric acid it was transformed into its cyclic isomer, *ionone*. From the chemical point of view, *ionone* not being identical with *irone*, but only an isomer, the problem could not be said to be solved; but it was fully solved from the industrial point of view. *Ionone* possesses, like *irone*, the perfume of the violet, with a slight shade perceptible to practiced noses, but lending itself admirably to all the uses of perfumery. We have in this a complete example of methodical synthesis, although it must be admitted that the authors were aided by happy combinations of circumstances that might not always occur.

There are also chance syntheses. Thus, a substance, the odor of which may be utilized, is sometimes fallen upon in pursuing researches undertaken for another purpose. This is what happened, for example, in the case of Baur's artificial musk. M. Baur had undertaken the study of two carbides of hydrogen—two butyltoluenes contained in the essence of resin. He isolated and separated these substances, and then in experiments connected with the performance of the synthesis he perceived an extremely pronounced odor of musk appertaining to the trinitrile derivative of isobutyltoluene. M. Baur was not led to his researches by chance, but the discovery of his musk, the most precious result of them, was not anticipated by him.

There are other cases in which a series of bodies are prepared with full expectation of what the chemical results will be, but without knowing what odor they will have, or whether they will be odoriferous, but with the expectation that they will be, and

that some may be found among them the odors of which can be utilized.

Syntheses of this kind only rarely lead to natural principles; more frequently what perfumers call chemical products are obtained, or perfumes which betray their origin to a greater or less extent, and can not be used in the preparation of the finest products, but have cheapness and great strength in their favor. We should observe that chemical synthesis takes to the odorous principle itself, while essences contain only a very slight proportion of the active substance.

Finally, it sometimes happens that no new material is discovered, but some laboratory reaction already known is turned to industrial use. Such is the case with heliotropine, formerly known as piperonylic aldehyde or piperonal; terpineol, or white lilac; anisic aldehyde, or hawthorn, etc.

Twenty-five or thirty years ago it was believed that with a few well-known exceptions, such as those of bitter almonds, anise, mustard, and some others, the essences were constituted of hydrocarbons, $C_{10}H_{16}$ in indefinite numbers, all isomeric and similar to spirits of turpentine. Our views on this subject have been considerably modified. It has been found that the hydrocarbons or terpenes contained in essences may be referred to well-defined species possessing characteristic reactions and derivatives, some of them crystallizable, by which they may be distinguished. Oxidized principles have been isolated in essences related to the fatty series, capable of facile transformation into cyclic derivatives, which may be regarded as connecting links between the fatty and the aromatic series. Frequently a natural essence represents a harmonious mixture of various combinations. Oil of bergamot, having a composition of this character, possesses an odor vastly more characteristic than any of its components taken separately. And it sometimes happens that compounds suitable for fine perfumery, if they were pure, are spoiled by the presence of disagreeably smelling substances. The elimination of such principles, or the refining of such perfumes, has given rise to a second branch of our chemical industry.

The discoveries that have so far been made are quite insufficient to explain the composition and odor of essences. We find certain substances, like linalool and geraniol, common constituents in essences of the most different characters, and are hence forced to recognize that in a great number of cases they are only the vehicle, the substratum, of the really characteristic perfume; and we begin to suspect the presence of still rarer principles corresponding probably with a more differentiated, more specialized organism, and related to the specific characteristics of the vegetable cell.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

ARCHÆOLOGY AND THE ANTIQUITY OF MAN.*

BY SIR JOHN EVANS, K. C. B., D. C. L., LL. D., Sc. D.

ONCE more has the Dominion of Canada invited the British Association for the Advancement of Science to hold one of the annual meetings of its members within the Canadian territory, and for a second time has the association had the honor and pleasure of accepting the proffered hospitality. In doing so the association has felt that if by any possibility the scientific welfare of a locality is promoted by its being the scene of such a meeting, the claims should be fully recognized of those who, though not dwelling in the British Isles, are still inhabitants of that Greater Britain, whose prosperity is so intimately connected with the fortunes of the mother country. Here, especially, as loyal subjects of one beloved sovereign, the sixtieth year of whose beneficent reign has just been celebrated with equal rejoicing in all parts of her empire, as speaking the same tongue, and as in most instances connected by the ties of one common parentage, we are bound together in all that can promote our common interests. There is, in all probability, nothing that will tend more to advance those interests than the diffusion of science in all parts of the British Empire, and it is toward this end that the aspirations of the British Association are ever directed, even if, in many instances, the aim may not be attained.

We are, as already mentioned, indebted to Canada for previous hospitality, but we must also remember that, since the time when we last assembled on this side of the Atlantic, the Dominion has provided the association with a president, Sir William Dawson, whose name is alike well known in Britain and America, and whose reputation is indeed world-wide. We rejoice that we have still among us the pioneer of American geology, who, among other discoveries, first made us acquainted with the "Air Breathers of the Coal," the terrestrial or, more properly, arboreal saurians of the New Brunswick and Nova Scotia coal measures.

On our last visit to Canada, in 1884, our place of assembly was Montreal, a city which is justly proud of her McGill University; to-day we meet within the buildings of another of the universities of this vast Dominion, and in a city the absolute fitness of which for such a purpose must have been foreseen by the native Indian tribes when they gave to a small aggregation of huts upon this spot the name of Toronto—"the place of meetings." Our gathering this

* Presidential address delivered at the annual meeting of the British Association for the Advancement of Science at Toronto, 1897.

year presents a feature of entire novelty and extreme interest, inasmuch as the sister association of the United States of America—still mourning the loss of her illustrious president, Professor Cope—and some other learned societies have made special arrangements to allow of their members coming here to join us. I need hardly say how welcome their presence is, or how gladly we look forward to their taking part in our discussions and aiding us by interchange of thought. To such a meeting the term “international” seems almost misapplied. It may rather be described as a family gathering, in which our relatives more or less distant in blood, but still intimately connected with us by language, literature, and habits of thought, have spontaneously arranged to take part. The domain of science is no doubt one in which the various nations of the civilized world meet upon equal terms, and for which no other passport is required than some evidence of having striven toward the advancement of natural knowledge. Here, on the frontier between the two great English-speaking nations of the world, who is there that does not inwardly feel that anything which conduces to an intimacy between the representatives of two countries, both of them actively engaged in the pursuit of science, may also, through such an intimacy, react on the affairs of daily life and aid in preserving those cordial relations that have now for so many years existed between the great American Republic and the British Islands, with which her early foundations are indissolubly connected? The present year has witnessed an interchange of courtesies which has excited the warmest feelings of approbation on both sides of the Atlantic—I mean the return to its proper custodians of one of the most interesting of the relics of the Pilgrim Fathers, the log of the Mayflower. May this return, trifling in itself, be of happy augury as testifying to the feelings of mutual regard and esteem which animate the hearts both of the donors and of the recipients!

At our meeting in Montreal the president was an investigator who had already attained to a foremost place in the domains of physics and mathematics, Lord Rayleigh. In his address he dealt mainly with topics such as light, heat, sound, and electricity, on which he is one of our principal authorities. His name and that of his fellow-worker, Professor Ramsay, are now and will in all future ages be associated with the discovery of the new element, argon. Of the ingenious methods by which that discovery was made, and the existence of argon established, this is not the place to speak. One can only hope that the element will not always continue to justify its name by its inertness. The claims of such a leader in physical science as Lord Rayleigh to occupy the presidential chair are self-evident, but possibly those of his successor on this side of the Atlantic

are not so immediately apparent. I can not for a moment pretend to place myself on the same purely scientific level as my distinguished friend and for many years colleague, Lord Rayleigh, and my claims, such as they are, seem to me to rest on entirely different grounds. Whatever little I may have indirectly been able to do in assisting to promote the advancement of science, my principal efforts have now for many years been directed toward attempting to forge those links in the history of the world, and especially of humanity, that connect the past with the present, and toward tracing that course of evolution which plays as important a part in the physical and moral development of man as it does in that of the animal and vegetable creation. It appears to me, therefore, that my election to this important post may, in the main, be regarded as a recognition by this association of the value of archæology as a science. Leaving all personal considerations out of question, I gladly hail this recognition, which is, indeed, in full accordance with the attitude already for many years adopted by the association toward anthropology, one of the most important branches of true archæology.

It is no doubt hard to define the exact limits which are to be assigned to archæology as a science and archæology as a branch of history and *belles lettres*. A distinction is frequently drawn between science on the one hand and knowledge or learning on the other; but translate the terms into Latin and the distinction at once disappears. In illustration of this I need only cite Bacon's great work on the Advancement of Learning, which was, with his own aid, translated into Latin under the title *De Augmentis Scientiarum*. It must, however, be acknowledged that a distinction does exist between archæology proper and what, for want of a better word, may be termed antiquarianism. It may be interesting to know the internal arrangements of a Dominican convent in the middle ages; to distinguish between the different moldings characteristic of the principal styles of Gothic architecture; to determine whether an English coin bearing the name of Henry was struck under Henry II, Richard, John, or Henry III; or to decide whether some given edifice was erected in Roman, Saxon, or Norman times. But the power to do this, though involving no small degree of detailed knowledge and some acquaintance with scientific methods, can hardly entitle its possessors to be enrolled among the votaries of science. A familiarity with all the details of Greek and Roman mythology and culture must be regarded as a literary rather than a scientific qualification; and yet when among the records of classical times we come upon traces of manners and customs which have survived for generations, and which seem to throw some rays of light upon the dim

past, when history and writing were unknown, we are, I think, approaching the boundaries of scientific archæology.

Every reader of Virgil knows that the Greeks were not merely orators, but that with a pair of compasses they could describe the movements of the heavens and fix the rising of the stars; but when by modern astronomy we can determine the heliacal rising of some well-known star, with which the worship in some given ancient temple is known to have been connected, and can fix its position on the horizon at some particular spot, say, three thousand years ago, and then find that the axis of the temple is directed exactly toward that spot, we have some trustworthy scientific evidence that the temple in question must have been erected at a date approximately 1100 years B. C. If on or close to the same site we find that more than one temple was erected, each having a different orientation, these variations, following, as they may fairly be presumed to do, the changing position of the rising of the dominant star, will also afford a guide as to the chronological order of the different foundations. The researches of Mr. Penrose seem to show that in certain Greek temples, of which the date of foundation is known from history, the actual orientation corresponds with that theoretically deduced from astronomical data. Sir J. Norman Lockyer has shown that what holds good for Greek temples applies to many of far earlier date in Egypt, though up to the present time hardly a sufficient number of accurate observations have been made to justify us in foreseeing all the instructive results that may be expected to arise from astronomy coming to the aid of archæology. The intimate connection of archæology with other sciences is in no case so evident as with respect to geology, for when considering subjects such as those I shall presently discuss it is almost impossible to say where the one science ends and the other begins.

By the application of geological methods many archæological questions relating even to subjects on the borders of the historical period have been satisfactorily solved. A careful examination of the limits of the area over which its smaller coins are found has led to the position of many an ancient Greek city being accurately ascertained; while in England it has only been by treating the coins of the ancient Britons, belonging to a period before the Roman occupation, as if they were actual fossils that the territories under the dominion of the various kings and princes who struck them have been approximately determined. In arranging the chronological sequence of these coins, the evolution of their types—a process almost as remarkable, and certainly as well defined, as any to be found in Nature—has served as an efficient guide. I may venture to add that the results obtained from the study of the

morphology of this series of coins were published ten years before the appearance of Darwin's great work on the *Origin of Species*. When we come to the consideration of the relics of the early iron and bronze ages the aid of chemistry has of necessity to be invoked. By its means we are able to determine whether the iron of a tool or weapon is of meteoritic or volcanic origin, or has been reduced from iron ore, in which case considerable knowledge of metallurgy would be involved on the part of those who made it. With bronze antiquities the nature and extent of the alloys combined with the copper may throw light not only on their chronological position but on the sources whence the copper, tin, and other metals of which they consist were originally derived. I am not aware of there being sufficient differences in the analyses of the native copper from different localities in the region in which we are assembled for Canadian archæologists to fix the sources from which the metal was obtained which was used in the manufacture of the ancient tools and weapons of copper that are occasionally discovered in this part of the globe. Like chemistry, mineralogy and petrology may be called to the assistance of archæology in determining the nature and source of the rocks of which ancient stone implements are made; and, thanks to researches of the followers of those sciences, the old view that all such implements formed of jade and found in Europe must of necessity have been fashioned from material imported from Asia can no longer be maintained. In one respect the archæologist differs in opinion from the mineralogist—namely, as to the propriety of chipping off fragments from perfect and highly finished specimens for the purpose of submitting them to microscopic examination.

I have hitherto been speaking of the aid that other sciences can afford to archæology when dealing with questions that come almost, if not quite, within the fringe of history, and belong to times when the surface of our earth presented much the same configuration as regards the distribution of land and water and hill and valley as it does at present, and when in all probability the climate was much the same as it now is. When, however, we come to discuss that remote age in which we find the earliest traces that are at present known of man's appearance upon earth the age of geology and paleontology becomes absolutely imperative. The changes in the surface configuration and in the extent of the land, especially in a country like Britain, as well as the modifications of the fauna and flora since those days, have been such that the archæologist pure and simple is incompetent to deal with them, and he must either himself undertake the study of these other sciences or call experts in them to his assistance. The evidence that man had already appeared upon the earth is afforded by stone implements wrought by

his hands, and it falls strictly within the province of the archæologist to judge whether given specimens were so wrought or not; it rests with the geologist to determine their stratigraphical or chronological position, while the paleontologist can pronounce upon the age and character of the associated fauna and flora. If left to himself the archæologist seems too prone to build up theories founded upon form alone, irrespective of geological conditions. The geologist, unaccustomed to archæological details, may readily fail to see the difference between the results of the operations of Nature and those of art, and may be liable to trace the effects of man's handiwork in the chipping, bruising, and wearing which in all ages result from natural forces; but the united labors of the two, checked by those of the paleontologist, can not do otherwise than lead toward sound conclusions.

It will perhaps be expected of me that I should on the present occasion bring under review the state of our present knowledge with regard to the antiquity of man; and probably no fitter place could be found for the discussion of such a topic than the adopted home of my venerated friend, the late Sir Daniel Wilson, who first introduced the word "prehistoric" into the English language. Some among us may be able to call to mind the excitement not only among men of science but among the general public when, in 1859, the discoveries of M. Boucher de Perthes and Dr. Rigollot in the gravels of the valley of the Somme, at Abbeville and Amiens, were confirmed by the investigations of the late Sir Joseph Prestwich, myself, and others, and the co-existence of man with the extinct animals of the Quaternary fauna, such as the mammoth and woolly-haired rhinoceros, was first virtually established. It was at the same time pointed out that these relics belonged to a far earlier date than the ordinary stone weapons found upon the surface, which usually showed signs of grinding or polishing, and that, in fact, there were two stone ages in Britain. To these the terms "neolithic" and "palæolithic" were subsequently applied by Sir John Lubbock. The excitement was not less when, at the meeting of this association at Aberdeen in the autumn of that year, Sir Charles Lyell, in the presence of the Prince Consort, called attention to the discoveries in the valley of the Somme, the site of which he had himself visited, and to the vast lapse of time indicated by the position of the implements in drift deposits a hundred feet above the existing river. The conclusions forced upon those who examined the facts on the spot did not receive immediate acceptance by all who were interested in geology and archæology, and fierce were the controversies on the subject that were carried on both in the newspapers and before various learned societies. It is at the same time instructive and amus-

ing to look back on the discussions of those days. While one class of objectors accounted for the configuration of the flint implements from the gravels by some unknown chemical agency, by the violent and continued gyratory action of water, by fracture resulting from pressure, by rapid cooling when hot, or by rapid heating when cold, or even regarded them as aberrant forms of fossil fishes, there were others who, when compelled to acknowledge that the implements were the work of men's hands, attempted to impugn and set aside the evidence as to the circumstances under which they had been discovered. In doing this they adopted the view that the worked flints had either been introduced into the containing beds at a comparatively recent date, or if they actually formed constituent parts of the gravel then that this was a mere modern alluvium resulting from floods at no very remote period. In the course of a few years the main stream of scientific thought left this controversy behind, though a tendency to cut down the lapse of time necessary for all the changes that have taken place in the configuration of the surface of the earth and in the character of its occupants since the time of the palæolithic gravels still survives in the inmost recesses of the hearts of not a few observers.

In his address to this association at the Bath meeting of 1864 Sir Charles Lyell struck so true a note that I am tempted to reproduce the paragraph to which I refer: "When speculations on the long series of events which occurred in the Glacial and Post-glacial periods are indulged in, the imagination is apt to take alarm at the immensity of the time required to interpret the monuments of these ages, all referable to the era of existing species. In order to abridge the number of centuries which would otherwise be indispensable, a disposition is shown by many to magnify the rate of change in pre-historic times by investing the causes which have modified the animate and inanimate world with extraordinary and excessive energy. It is related of a great Irish orator of our day that when he was about to contribute somewhat parsimoniously toward a public charity he was persuaded by a friend to make a more liberal donation. In doing so he apologized for his first apparent want of generosity by saying that his early life had been a constant struggle with scanty means, and that 'they who are born to affluence can not easily imagine how long a time it takes to get the chill of poverty out of one's bones.' In like manner we of the living generation, when called upon to make grants of thousands of centuries in order to explain the events of what is called the modern period, shrink naturally at first from making what seems so lavish an expenditure of past time. Throughout our early education we have been accustomed to such strict economy in all that relates to the chronol-

ogy of the earth and its inhabitants in remote ages, so fettered have we been by old traditional beliefs, that even when our reason is convinced and we are persuaded that we ought to make more liberal grants of time to the geologist, we feel how hard it is to get the chill of poverty out of our bones." Many, however, have at the present day got over this feeling, and of late years the general tendency of those engaged upon the question of the antiquity of the human race has been in the direction of seeking for evidence by which the existence of man upon the earth could be carried back to a date earlier than that of the Quaternary gravels. There is little doubt that such evidence will eventually be forthcoming, but, judging from all probability, it is not in northern Europe that the cradle of the human race will eventually be discovered, but in some part of the world more favored by a tropical climate, where abundant means of subsistence could be procured, and where the necessity for warm clothing did not exist. Before entering into speculations on this subject, or attempting to lay down the limits within which we may safely accept recent discoveries as firmly established, it will be well to glance at some of the cases in which implements are stated to have been found under circumstances which raise a presumption of the existing of man in Pre-glacial, Pliocene, or even Miocene times.

Flint implements of ordinary palæolithic type have, for instance, been recorded as found in the eastern counties of England in beds beneath the chalky boulder clay; but on careful examination the geological evidence has not to my mind proved satisfactory, nor has it, I believe, been generally accepted. Moreover, the archæological difficulty that man, at two such remote epochs as the Pre-glacial and the Post-glacial, even if the term "glacial" be limited to the chalky boulder clay, should have manufactured implements so identical in character that they can not be distinguished apart, seems to have been entirely ignored. Within the last few months we have had the report of worked flints having been discovered in the late Pliocene forest bed of Norfolk, but in that instance the signs of human workmanship upon the flints are by no means apparent to all observers. But such an antiquity as that of the forest bed is as nothing when compared with that which would be implied by the discoveries of the work of men's hands in the Pliocene and Miocene beds of England, France, Italy, and Portugal, which have been accepted by some geologists. There is one feature in these cases which has hardly received due attention, and that is the isolated character of the reputed discoveries. Had man, for instance, been present in Britain during the crag period, it would be strange indeed if the sole traces of his existence that he left were a perforated tooth of a

large shark, the sawn rib of a manatee, and a beaming full face carved on the shell of a pectunculus!

In an address to the Anthropological Section at the Leeds meeting of this association in 1890 I dealt somewhat fully with these supposed discoveries of the remains of human art in beds of Tertiary date; and I need not here go further into the question. Suffice it to say that I see no reason why the verdict of "not proven," at which I then arrived, should be reversed. In the case of a more recent discovery in upper Burma in beds at first pronounced to be upper Miocene, but subsequently "definitely ascertained to be Pliocene," some of the flints are of purely natural and not artificial origin, so that two questions arise: First, were the fossil remains associated with the worked flints or with those of natural forms? and second, were they actually found in the bed to which they have been assigned, or did they merely lie together on the surface? Even the *Pithecanthropus erectus* of Dr. Eugène Dubois from Java meets with some incredulous objectors from both the physiological and the geological sides. From the point of view of the latter the difficulty lies in determining the exact age of what are apparently alluvial beds in the bottom of a river valley.

When we return to palæolithic man it is satisfactory to feel that we are treading on comparatively secure ground, and that the discoveries of the last forty years in Britain alone enable us to a great extent to reconstitute his history. We may not know the exact geological period when first he settled in the British area, but we have good evidence that he occupied it at a time when the configuration of the surface was entirely different from what it is at present, when the river valleys had not been cut down to anything like their existing depth, when the fauna of the country was of a totally different character from that of the present day, when the extension of the southern part of the island seaward was in places such that the land was continuous with that of the continent, and when in all probability a far more rainy climate prevailed. We have proofs of the occupation of the country by man during the long lapse of time that was necessary for the excavation of the river valleys. We have found the old floors on which his habitations were fixed, we have been able to trace him at work on the manufacture of flint instruments, and by building up the one upon the other the flakes struck off by the primeval workman in those remote times we have been able to reconstruct the blocks of flint which served as his material. That the duration of the palæolithic period must have extended over an almost incredible length of time is sufficiently proved by the fact that valleys, some miles in width and of a depth of from one hundred to one hundred and fifty feet, have been eroded since

the deposit of the earliest implement-bearing beds. Nor is the apparent duration of this period diminished by the consideration that the floods which hollowed out the valleys were not in all probability of such frequent occurrence as to teach palæolithic man by experience the danger of settling too near to the streams, for had he kept to the higher slopes of the valley there would have been but little chance of his implements having so constantly formed constituent parts of the gravels deposited by the floods.

The examination of British cave deposits affords corroborative evidence of this extended duration of the palæolithic period. In Kent's Cavern at Torquay, for instance, we find in the lowest deposit, the breccia below the red cave earth, implements of flint and chert corresponding in all respects with those of the high level and most ancient river gravels. In the cave earth these are scarcer, though implements occur which also have their analogues in the river deposits; but, what is more remarkable, harpoons of reindeer's horn and needles of bone are present, identical in form and character with those of the caverns of the reindeer period in the south of France, and suggestive of some bond of union or identity of descent between the early troglodytes, whose habitations were geographically so widely separated the one from the other.

In a cavern at Creswell Crags, on the confines of Derbyshire and Nottinghamshire, a bone has, moreover, been found engraved with a representation of parts of a horse in precisely the same style as the engraved bones of the French caves. It is uncertain whether any of the river-drift specimens belong to so late a date as these artistic cavern remains; but the greatly superior antiquity of even these to any neolithic relics is testified by the thick layer of stalagmite which had been deposited in Kent's Cavern before its occupation by men of the neolithic and bronze periods. Toward the close of the period covered by the human occupation of the French caves there seems to have been a dwindling in the number of the larger animals constituting the Quaternary fauna, whereas their remains are present in abundance in the lower and therefore more recent of the valley gravels. This circumstance may afford an argument in favor of regarding the period represented by the later French caves as a continuation of that during which the old river gravels were deposited, and yet the great change in the fauna that has taken place since the latest of the cave deposits included in the palæolithic period is indicative of an immense lapse of time. How much greater must have been the time required for the more conspicuous change between the old Quaternary fauna of the river gravels and that characteristic of the neolithic period! As has been pointed out by Prof. Boyd Dawkins, only thirty-one out of the forty-eight well-

ascertained species living in the Post-glacial or river-drift period survived into prehistoric or neolithic times. We have not, indeed, any means at command for estimating the number of centuries which such an important change indicates; but when we remember that the date of the commencement of the neolithic or surface stone period is still shrouded in the mist of a dim antiquity, and that prior to that commencement the river-drift period had long come to an end; and when we further take into account the almost inconceivable ages that even under the most favorable conditions the excavation of wide and deep valleys by river action implies, the remoteness of the date at which the palæolithic period had its beginning almost transcends our powers of imagination. We find distinct traces of river action from one hundred to two hundred feet above the level of existing streams and rivers, and sometimes at a great distance from them; we observe old fresh-water deposits on the slopes of the valleys several miles in width; we find that long and lofty escarpments of rock have receded unknown distances since their summits were first occupied by palæolithic man; we see that the whole side of a wide river valley has been carried away by an invasion of the sea, which attacked and removed a barrier of chalk cliffs from four hundred to six hundred feet in height; we find that what was formerly an inland river has been widened out into an arm of the sea, now the highway of our fleets, and that gravels which were originally deposited in the bed of some ancient river now cap isolated and lofty hills.

And yet, remote as the date of the first known occupation of Britain by man may be, it belongs to what, geologically speaking, must be regarded as a quite recent period, for we are now in a position to fix with some degree of accuracy its place on the geological scale. Thanks to investigations ably carried out at Hoxne, in Suffolk, and at Hitchin, in Hertfordshire, by Mr. Clement Reid, under the auspices of this association and of the Royal Society, we know that the implement-bearing beds at those places undoubtedly belong to a time subsequent to the deposit of the great chalky bowlder clay of the eastern counties of England. It is, of course, self-evident that this vast deposit, in whatever manner it may have been formed, could not for centuries after its deposition was complete have presented a surface inhabitable by man. Moreover, at a distance but little farther north beds exist which also, though at a somewhat later date, were apparently formed under glacial conditions. At Hoxne the interval between the deposit of the bowlder clay and of the implement-bearing beds is distinctly proved to have witnessed at least two noteworthy changes in climate. The beds immediately reposing on the clay are characterized by the presence

of alder in abundance, of hazel and yew, as well as by that of numerous flowering plants indicative of a temperate climate very different from that under which the bowlder clay itself was formed. Above these beds, characterized by temperate plants, comes a thick and more recent series of strata, in which leaves of the dwarf arctic willow and birch abound, and which were in all probability deposited under conditions like those of the cold regions of Siberia and North America. At a higher level and of more recent date than these—from which they are entirely distinct—are the beds containing palæolithic implements, formed in all probability under conditions not essentially different from those of the present day. However this may be, we have now conclusive evidence that the palæolithic implements are, in the eastern counties of England, of a date long posterior to that of the great chalky bowlder clay.

It may be said, and said truly, that the implements at Hoxne can not be shown to belong to the beginning rather than to some later stage of the palæolithic period. The changes, however, that have taken place at Hoxne in the surface configuration of the country prove that the beds containing the implements can not belong to the close of that period. It must, moreover, be remembered that in what are probably the earliest of the palæolithic deposits of the eastern counties, those at the highest level, near Brandon in Norfolk, where the gravels contain the largest proportion of pebbles derived from glacial beds, some of the implements themselves have been manufactured from materials not native to the spot, but brought from a distance, and derived in all probability either from the bowlder clay or from some of the beds associated with it. We must, however, take a wider view of the whole question, for it must not for a moment be supposed that there are the slightest grounds for believing that the civilization, such as it was, of the palæolithic period originated in the British Isles. We find in other countries implements so identical in form and character with British specimens that they might have been manufactured by the same hands. These occur over large areas in France under similar conditions to those that prevail in England. The same forms have been discovered in the ancient river gravels of Italy, Spain, and Portugal. Some few have been recorded from the north of Africa, and analogous types occur in considerable numbers in the south of that continent. On the banks of the Nile, many hundreds of feet above its present level, implements of the European types have been discovered; while in Somaliland, in an ancient river valley at a great elevation above the sea, Mr. Seton-Karr has collected a large number of implements formed of flint and quartzite, which, judging from their form and character, might have been dug out of the drift deposits of the

Somme of the Seine, the Thames or the ancient Solent. In the valley of the Euphrates implements of the same kind have also been found, and again farther east in the lateritic deposits of southern India they have been obtained in considerable numbers. It is not a little remarkable, and is at the same time highly suggestive, that a form of implement almost peculiar to Madras reappears among implements from the very ancient gravels of the Manzanares at Madrid. In the case of the African discoveries we have as yet no definite paleontological evidence by which to fix their antiquity, but in the Narbadá Valley of western India palæolithic implements of quartzite seem to be associated with a local fauna of Pleistocene age, comprising, like that of Europe, the elephant, hippopotamus, ox, and other mammals of species now extinct. A correlation of the two faunas with a view of ascertaining their chronological relations is beset with many difficulties, but there seems reason for accepting this Indian Pleistocene fauna as in some degree more ancient than the European.

Is this not a case in which the imagination may be fairly invoked in aid of science? May we not from these data attempt in some degree to build up and reconstruct the early history of the human family? There, in eastern Asia, in a tropical climate, with the means of subsistence readily at hand, may we not picture to ourselves our earliest ancestors gradually developing from a lowly origin, acquiring a taste for hunting, if not indeed being driven to protect themselves from the beasts around them, and evolving the more complicated forms of tools or weapons from the simpler flakes which had previously served them as knives? May we not imagine that when once the stage of civilization denoted by these palæolithic implements had been reached the game for the hunter became scarcer, and that his life in consequence assumed a more nomad character? Then, and possibly not till then, may a series of migrations to "fresh woods and pastures new" not unnaturally have ensued, and these following the usual course of "westward toward the setting sun" might eventually lead to a palæolithic population finding its way to the extreme borders of western Europe, where we find such numerous traces of its presence. How long a term of years may be involved in such a migration it is impossible to say, but that such a migration took place the phenomena seem to justify us in believing. It can hardly be supposed that the process that I have shadowed forth was reversed, and that man, having originated in northwestern Europe, in a cold climate where clothing was necessary and food scarce, subsequently migrated eastward to India and southward to the Cape of Good Hope. As yet our records of discoveries in India and eastern Asia are but scanty; but it is there that

the traces of the cradle of the human race are, in my opinion, to be sought, and possibly future discoveries may place upon a more solid foundation the visionary structure that I have ventured to erect.

It may be thought that my hypothesis does not do justice to what Sir Thomas Browne has so happily termed "that great antiquity, America." I am, however, not here immediately concerned with the important neolithic remains of all kinds with which this great continent abounds. I am now confining myself to the question of palæolithic man and his origin, and in considering it I am not unmindful of the Trenton implements, though I must content myself by saying that the "turtle-back" form is essentially different from the majority of those on the wide dissemination of which I have been speculating, and, moreover, as many here present are aware, the circumstances of the finding of these American implements are still under careful discussion. Leaving them out of the question for the present, it may be thought worth while to carry our speculations rather further, and to consider the relations in time between the palæolithic and the neolithic periods. We have seen that the stage in human civilization denoted by the use of the ordinary forms of palæolithic implements must have extended over a vast period of time if we have to allow for the migration of the primeval hunters from their original home, wherever it may have been in Asia or Africa, to the west of Europe, including Britain. We have seen that during this migration the forms of the weapons and tools made from siliceous stones had become, as it were, stereotyped, and, further, that during the subsequent extended period implied by the erosion of the valleys the modifications in the form of the implements and the changes in the fauna associated with the men who used them were but slight. At the close of the period during which the valleys were being eroded comes that represented by the latest occupation of the caves by palæolithic man, when both in Britain and in the south of France the reindeer was abundant; but among the stone weapons and implements of that long troglodytic phase of man's history not a single example with the edge sharpened by grinding has as yet been found. All that can safely be said is that the larger implements, as well as the larger mammals, had become scarcer, that greater power in chipping flint had been attained, that the arts of the engraver and the sculptor had considerably developed, and that the use of the bow had probably been discovered. Directly we encounter the relics of the neolithic period, often, in the case of the caves lately mentioned, separated from the earlier remains by a thick layer of underlying stalagmite, we find flint hatchets polished at the edge and on the surface, cutting at the broad and not at the

narrow end, and other forms of implements associated with a fauna in all essential respects identical with that of the present day.

Were the makers of these polished weapons the direct descendants of palæolithic ancestors whose occupation of the country was continuous from the days of the old river gravels? or had these long since died out, so that after western Europe had for ages remained uninhabited it was repopled in neolithic times by the immigration of some new race of men? Was there, in fact, a "great gulf fixed" between the two occupations? or was there in Europe a gradual transition from the one stage of culture to the other? It has been said that "what song the sirens sang, or what name Achilles assumed when he hid himself among women, though puzzling questions, are not beyond all conjecture"; and though the questions now proposed may come under the same category, and must await the discovery of many more essential facts before they receive definite and satisfactory answers, we may, I think, throw some light upon them if we venture to take a few steps upon the seductive if insecure paths of conjecture. So far as I know we have as yet no trustworthy evidence of any transition from the one age to the other, and the gulf between them remains practically unbridged. We can, indeed, hardly name the part of the world in which to seek for the cradle of neolithic civilization, though we know that traces of what appear to have been a stone-using people have been discovered in Egypt, and that what must be among the latest of the relics of their industry have been assigned to a date some thirty-five hundred to four thousand years before our era. The men of that time had attained to the highest degree of skill in working flint that has ever been reached. Their beautifully made knives and spearheads seem indicative of a culminating point reached after long ages of experience; but whence these artists in flint came or who they were is at present absolutely unknown, and their handiworks afford no clue to help us in tracing their origin. Taking a wider survey, we may say that, generally speaking, not only the fauna but the surface configuration of the country were, in western Europe at all events, much the same at the commencement of the neolithic period as they are at the present day. We have, too, no geological indications to aid us in forming any chronological scale.

The occupation of some of the caves in the south of France seems to have been carried on after the erosion of the neighboring river valleys had ceased, and so far as our knowledge goes these caves offer evidence of being the latest in time of those occupied by man during the palæolithic period. It seems barely possible that though in the north of Europe there are no distinct signs of such late occupation, yet that in the south man may have lived on, though

in diminished numbers; and that in some of the caves, such, for instance, as those in the neighborhood of Mentone, there may be traces of his existence during the transitional period that connects the palæolithic and neolithic ages. If this were really the case, we might expect to find some traces of a dissemination of neolithic culture from a north Italian center, but I much doubt whether any such traces actually exist. If it had been in that part of the world that the transition took place, how are we to account for the abundance of polished stone hatchets found in central India? Did neolithic man return eastward by the same route as that by which in remote ages his palæolithic predecessor had migrated westward? Would it not be in defiance of all probability to answer such a question in the affirmative? We have, it must be confessed, nothing of a substantial character to guide us in these speculations; but, pending the advent of evidence to the contrary, we may, I think, provisionally adopt the view that owing to failure of food, climatal changes, or other causes, the occupation of western Europe by palæolithic man absolutely ceased, and that it was not until after an interval of long duration that Europe was repeopled by a race of men immigrating from some other part of the globe where the human race had survived, and in course of ages had developed a higher stage of culture than that of palæolithic man.

I have been carried away by the liberty allowed for conjecture into the regions of pure imagination, and must now return to the realms of fact, and one fact on which I desire for a short time to insist is that of the existence at the present day, in close juxtaposition with our own civilization, of races of men who—at all events but a few generations ago—lived under much the same conditions as did our own neolithic predecessors in Europe. The manners and customs of these primitive tribes and peoples are changing day by day, their languages are becoming obsolete, their myths and traditions are dying out, their ancient processes of manufacture are falling into oblivion, and their numbers are rapidly diminishing, so that it seems inevitable that ere long many of these interesting populations will become absolutely extinct. The admirable Bureau of Ethnology instituted by our neighbors in the United States of America has done much toward preserving a knowledge of the various native races in this vast continent; and here in Canada the annual Archæological Reports presented to the Minister of Education are rendering good service in the same cause. Moreover, the committee of this association appointed to investigate the physical characters, languages, and industrial and social conditions of the northwestern tribes of the Dominion of Canada is about to present its twelfth and final report, which, in conjunction with those already presented,

will do much toward preserving a knowledge of the habits and languages of those tribes. It is sad to think that Mr. Horatio Hale, whose comprehensive grasp of the bearings of ethnological questions, and whose unremitting labors have so materially conduced to the success of the committee, should be no longer among us. Although this report is said to be final, it is to be hoped that the committee may be able to indicate lines upon which future work in the direction of ethnological and archæological research may be profitably carried on in this part of her Majesty's dominions. It is, however, lamentable to notice how little is being or has been officially done toward preserving a full record of the habits, beliefs, arts, myths, languages, and physical characteristics of the countless other tribes and nations more or less uncivilized which are comprised within the limits of the British Empire. At the meeting of this association held last year at Liverpool it was resolved by the general committee "that it is of urgent importance to impress upon the Government the necessity of establishing a Bureau of Ethnology for Greater Britain, which, by collecting information with regard to the native races within and on the borders of the empire, will prove of immense value to science and to the Government itself." It has been suggested that such a bureau might with the greatest advantage and with the least outlay and permanent expense be connected either with the British Museum or with the Imperial Institute, and the project has already been submitted for the consideration of the trustees of the former establishment. The existence of an almost unrivaled ethnological collection in the museum, and the presence there of officers already well versed in ethnological research, seem to afford an argument in favor of the proposed bureau being connected with it. On the other hand, the Imperial Institute was founded with an especial view to its being a center around which every interest connected with the dependencies of the empire might gather for information and support. The establishment within the last twelve months of a scientific department within the institute, with well-appointed laboratories and a highly trained staff, shows how ready are those concerned in its management to undertake any duties that may conduce to the welfare of the outlying parts of the British Empire—a fact of which I believe that Canada is fully aware. The institute is therefore likely to develop, so far as its scientific department is concerned, into a bureau of advice in all matters scientific and technical, and certainly a Bureau of Ethnology such as that suggested would not be out of place within its walls. Wherever such an institution is to be established, the question of its existence must of necessity rest with her Majesty's Government and Treasury, inasmuch as without funds, however moderate, the

undertaking can not be carried on. I trust that in considering the question it will always be borne in mind that in the relations between civilized and uncivilized nations and races it is of the first importance that the prejudices, and especially the religious or semi-religious and caste prejudices of the latter should be thoroughly well known to the former. If but a single "little war" could be avoided in consequence of the knowledge acquired and stored up by the Bureau of Ethnology preventing such a misunderstanding as might culminate in warfare, the cost of such an institution would quickly be saved.

I fear that it will be thought that I have dwelt too long on primeval man and his modern representatives, and that I should have taken this opportunity to discuss some more general subject, such as the advances made in the various departments of science since last this association met in Canada. Such a subject would no doubt have afforded an infinity of interesting topics on which to dilate. Spectrum analysis, the origin and nature of celestial bodies, photography, the connection between heat, light, and electricity, the practical applications of the latter, terrestrial magnetism, the liquefaction and solidification of gases, the behavior of elements and compounds under the influence of extreme cold, the nature and uses of the Röntgen rays, the advances in bacteriology and in prophylactic medicine, might all have been passed under review, and to many of my audience would have seemed to possess greater claims to attention than the subject that I have chosen. It must, however, be borne in mind that most, if not indeed all, of these topics will be discussed by more competent authorities in the various sections of the association by means of the presidential addresses or otherwise. Nor must it be forgotten that I occupy this position as a representative of archæology, and am therefore justified in bringing before you a subject in which every member of every race of mankind ought to be interested—the antiquity of the human family and the scenes of its infancy.

Others will direct our thoughts in other directions, but the further we proceed the more clearly shall we realize the connection and interdependence of all departments of science. Year after year, as meetings of this association take place, we may also foresee that "many shall run to and fro and knowledge shall be increased." Year after year advances will be made in science and in reading that Book of Nature that lies ever open before our eyes; successive stones will be brought for building up that temple of knowledge of which our fathers and we have labored to lay the foundations. May we not well exclaim with old Robert Recorde: "Oh woorthy temple of Goddes magnificence: Oh throne of glorye and seate of

the lorde: thy substance most pure what tonge can describe? thy signes are so wonderous, surmountinge mannes witte, the effects of thy motions so diuers in kinde: so harde for to seache, and worse for to fynde—Thy woorkes are all wonderous, thy cunning unknowen: yet seedes of all knowledge in that booke are sown—And yet in that boke who rightly can reade, to all secrete knowledge it will him straighte leade.” *



AN EXPERIMENT IN CITIZEN TRAINING.

BY WINIFRED BUCK.

SO far as the present writer knows, Mr. Jacob A. Riis was the first person to say that it was a boy's energy and love of organization—not his badness—that made him join a street gang; Mr. Riis also added that energy and love of organization are just the characteristics to make the best members of a “boys' club.”

Mr. Riis and Mrs. Van Rensselaer (the President of the Public Education Association) have succeeded through their energy and perseverance in gaining permission of the Board of Education to open in the evenings certain rooms in one of the Tenth Ward school-houses. In these rooms, as soon as possible, clubs are to be opened for both boys and girls. To describe the restrictions and regulations concerning the organizing of these clubs would be out of place here, but it is hoped that in a few years every schoolhouse in New York will open certain rooms for the purpose, as the demand among boys and girls for such organizations is very great.

The first club which will be opened (called “club” in distinction from many organizations which are really more in the nature of “classes,” having definite instruction as a regular part of their programme) is to be “Junior Good Government Club No. 2.” This kind of club has no connection whatever with the more famous organizations of nearly the same name, but the title so well describes its chief purpose that it was thought best to adopt it. Junior Good Government Club No. 1 has been in existence for about four years in the University Settlement in Delancey Street. As it is the only one we know of which consciously follows certain principles, a description of it may be of interest to those who perhaps think of starting some such club themselves, or who might care to know what the first schoolhouse club is to be.

The club in question is composed of thirty-five boys, whose ages range from twelve to fifteen years. A greater number than thirty-

five could scarcely have full justice done them either during the first hour, when a large room and a small gymnasium are all they have to play a wonderful variety of games in, or during the last hour, when the allotted time would be insufficient for each boy to have his part in the discussion of the many subjects that come before the club for consideration.

Each of the two hours of the club's session has its special significance. During the first the boys and the large room with its many opportunities (and limitations also) represent the conditions of a primitive society, for the only law which seems necessary to make every one happy is a simple one, and is applied in this hour in its simplest way. This law is "perfect freedom for all, bounded only by the freedom of others." No one thing could teach the principles of this great law better than games, for not only must it be obeyed within each game, but it must be constantly observed in the relations of one to another, when, in a very limited space, many different kinds are being played at the same time.

Visitors have often seen some of the boys in "No. 1" playing modified baseball in the main part of the room, and others practicing trapeze and dumb-bell exercises in the gymnasium, while in odd corners and other available spots of both rooms boxing and wrestling matches were taking place at the same time that the more quiet boys were playing at tables the games that better suited their natures. All the boys realize so well that each one of them must make some concession for the good of all and for the safety of property, that these games are played with the utmost good nature, apparently great pleasure, and safety not only for the members but for the pictures and gas shades which decorate the walls.

During this first hour a great deal of noise is allowed; but it is only in harmony with the law of freedom that, should it become annoying, it must cease. During the usual amusements of this first hour, however, no one can fail to notice how noise adds to the spirit of gayety, and how it increases physical activity. Indeed, has a silent game of tag or baseball ever been heard of?

In this hour the director interferes as little as possible, although she is obliged, three or four times, to suggest some adaptation by which a greater number of boys can enjoy themselves. She can not remember a time, however, in which it has been necessary for her to more than *suggest* the change. Such a thing as dismissing any of the boys, or threatening to dismiss them if they will not accept the suggestion, is unheard of. In the experience of this writer all normal children prefer right to wrong. If one believes this, one must see at once that it is only fair to give them the chance *voluntarily* to do right first. The question, "Is this just, is this

fair?" (if it is in relation to a situation simple enough for a child to see all the bearings of) will be enough to make him choose instantly the right course. That is just what the first hour of freedom aims at giving—opportunities for seeing one another in clear and simple relations. It affords an excellent preparation, too, for the second hour when, to carry out the original idea, it might be said that a higher state of civilization is attained, and consequently it becomes necessary to build upon the simple fundamental law an apparently complicated system if justice and freedom are to be assured each member. It is soon found that the club (or society, to carry out the larger view of club life) should consist of members who not only are ready to comply with a general law, but who as individuals also possess certain characteristics. The wish to discuss these characteristics makes the first *raison d'être* of the business meeting. A few of the simpler rules of parliamentary law (which, by the way, typifies in itself almost perfectly the law of freedom and justice in complicated relations) are learned from Cushing's Manual. Officers are elected, and then the momentous question arises for discussion, "Do we want as members of our club boys who gamble, steal, smoke, or swear?" We can not wonder much that these are popular sports on the East Side. An overcrowded tenement house is not an inspiring or healthy place to play in. Baseball is forbidden, and running games are almost impossible in the streets. Roller skating and bicycling can not be said to have many devotees for obvious reasons. Thus boys of naturally fine characters are driven to stealing and gambling as the only fields in which to exercise their imaginations, and in which to find excitement and diversion. Of the reasons for these "sports" being wrong, a surprising number have never thought. However, in speaking in public before one's peers, it is possible from the moment the first word is uttered to feel ideas springing into life which one was never conscious of having had before, and to hear one's self arguing eloquently for some cause in which one had little interest two minutes before. The first attempt at self-expression calls together the hitherto scattered fragments of thoughts and impressions, and forms them into deep-rooted convictions. This happens all the time in the business meeting, when the necessity for making their own laws sets all the boys to thinking, and most of them to talking also. It is a bad boy indeed who will do very often what he has convinced *himself* is wrong.

After days of excited talk nearly every one in the club is ready to admit that it is wrong to steal and gamble, foolish to smoke, and vulgar to swear, and ready to make a law to the effect that these practices are forbidden to the members. The question of punishment for possible backsliders naturally comes next. The first ideas

on this subject are very crude. Punishment—very severe and the same for every folly and crime—satisfies them for a while, but the time surely comes when some one suggests the possibility of mitigating circumstances, and finally, after hours of discussion, punishment is graded. Then some one has the thought that, after all, punishment is not the word to be used, or, indeed, the idea to be carried out in a club, and that the various penalties paid for breaking laws (suspension or expulsion usually) should merely be regarded as a means of self-defense by the club, and as the natural consequence of crime by the offender. Little by little, from a crude and brutal or sentimentally weak set of laws, grows a constitution not only written in the correct form, but containing much truth and justice. But in starting a new club it is better for the director not to give the club a perfect constitution, for it is only the years of discussion and experience out of which that perfect constitution is evolved, that helps the boys. All the good that comes from club life must come slowly and gradually—so gradually that all the minutest details of the machine of government are known and understood by the boys, and acknowledged by them, one by one, to be necessary. Figuratively speaking, and perhaps stretching the idea a little to make the meaning clear, they have *broadly* in the two hours of the club's session, and in *detail* in the three years of club life and growth, lived through all the stages of man's development, from his simplest attempts at law-making thousands of years ago to the complex machinery by which we are governed to-day. By understanding the necessity for every law as it is made, the boys become willing law-keepers; they become intelligent ones also, for they see that constant watchfulness and thoughtfulness are necessary to keep those laws up to the ever-growing and changing requirements of humanity.

Although the ultimate authority is, of course, vested in the director, in the Junior Good Government Clubs the boys are encouraged to stand on their own feet, so to speak, and to make decisions on all questions themselves, as it is believed that in this way their characters will be strengthened and their reasoning powers developed. The director of "No. 1" goes so far as to tell her boys that she does not claim infallibility; that if they see any untruth in what she tells them, or any flaw in her logic, it will not signify disrespect or impertinence to argue against her, just as they would if they disagreed with an ordinary member. Indeed, more than once has the director humbly given in to the superior judgment of one of the boys. However, it is sometimes more convenient if the boys have not the habit of making points of order against her.

The importance of letting the boys see the *natural* consequences of wrong-doing is inestimable, and it is because of this that the de-

bates on the innumerable subjects in connection with club government are far more useful in moral development than debates on outside subjects—political or literary. After a decision in a debate on club affairs, the boys will see “how it works” in a week or two; they will also know the exact circumstances that led to the necessity for a decision.

It is also because of the value of seeing the natural consequences that it is better for a club of this kind to be governed by the laws which all have taken part in making, rather than by the director, who is apt to get mixed as to what are natural consequences and what are her own nerves.

It is a curious fact that the untrained boy, like the untrained man, when given the chance of self-government, falls at once into the way of devising the most ingenious and complicated bad government possible. Junior Good Government Club No. 1, and all the other clubs this writer knows, have lived through their Tammany Hall periods. When a year comes in which the majority of members have had two or three years’ training in the club, charges of bribery and corruption are few, but when the older members move out, and their places are filled from below by more youthful “politicians,” then the Tammany-Platt situation is inevitable sooner or later.

It is often asked if clubs of this kind are distinctly reformatory. The writer of this article once visited a criminal lunatic asylum, and after making a tour of the wards and having noticed the striking malformation of the heads and bodies of the patients, she asked one of the doctors if he knew how many of them owed their condition to lack of nourishment before and after birth. “Roughly speaking, fifty per cent,” he answered. If lack of nourishment can cause criminal insanity, it can cause simple criminal tendencies, and unfortunately insufficient and improper nourishment is the common condition among even those people whom we are wont to consider not “desperately poor.” To answer the question asked at the beginning of this paragraph, it is very doubtful if abnormal criminal children would be greatly benefited by Junior Good Government Clubs. Reformatory these clubs certainly are for those who have become criminal through environment only; but reform is not the chief object to be attained. Growth in character and reasoning power comes to a child after a few years in such a club, and many latent gifts are developed in his nature through the freedom to use all of himself. Such clubs are just as important for the children of rich and intelligent parents as for those of the poor and ignorant. Whether the former, with their many opportunities for enjoyment, would find clubs amusing is another question.

Although we said that the reform of criminals was not the chief objects of these clubs, nevertheless it is accomplished very frequently, and, what is even better, a higher and higher sense of honor and morality is developed in each boy every year of his club life. In most cases to have the intelligence to know what is right is to do right, and with growing perception, awakened by continually thinking, questioning, and reasoning, the most harmless act of one year appears to the boys a downright wrong-doing the next.

The success of the clubs in the public schools will depend very much on the help given by well-educated and sympathetic people of either sex. If three or four Junior Good Government Clubs could be established in the course of time in every school in New York, there would be less work for our political reformers to do twenty years hence. From the experience of several years it is safe to prophesy that boys who learn to run honestly and successfully their Junior Good Government Clubs are never going to try, in after years, to run *dishonestly* (but too successfully, in one sense) their city.

SKETCH OF CARL VOGT.

CARL CHRISTOPH VOGT, the eldest of a family of nine children, was born in Giessen, Hesse, July 5, 1817, the son of Dr. Wilhelm Vogt, professor of clinics in the university of that place, and Louise Follenius. Professor Vogt, the father, lived honored and beloved by the people of Giessen, but frowned upon in official circles on account of his independent democratic spirit. Of the family of Madame Vogt, the father was a judge highly esteemed for his probity and erudition, but mistrusted by the Government, while her three brothers went far to confirm that mistrust by being, besides jurists, soldiers, and poets, republicans who in time had to be expelled from the country. One of these brothers, Karl Theodor Christian Follenius, implicated in the assassination of Kotzebue, became known in this country as Prof. Charles Follen, of Harvard University, author of German text-books, poet, Unitarian minister, and one of the victims of the burning of the steamer Lexington on Long Island Sound in 1840.

Carl Vogt's boyhood exhibited no special features, but was much like that of other boys. He was fond of going with his younger brother Emil on pedestrian tours. Being rather fat, he was a little awkward in gymnastics, but attained great skill in sword combats, in which he usually came off victor.

The days of listless study and fencing came to an end, and Vogt

entered the laboratory of Liebig as a medical student. The system pursued there was a novel one in those days. The pupil was given a task to perform, and was left to himself to work out his own way and solve the problem as best he might. The next morning the students were called upon to describe what they had done and what they had discovered. A company of bright young men, who afterward became famous in science, was then collected around Liebig's tables, and Vogt formed strong friendships with some of them. During this period of study with Liebig the elder Vogt accepted a professorship in Bern, Switzerland, and removed thither.

Carl Vogt had completed his first memoir, on the Water of the Amnios at Different Periods of Fœtal Life (published in 1837), and was still thinking of no other career than that of chemistry, when he gave shelter to a law student who had been implicated in a plot against the Government, and kept him in his room till the search for him became dangerous. The student was sent away in one direction and Vogt sought refuge with his uncle Bose, forester to the Grand Duke at Jugenheim. The Grand Duke himself was enjoying a holiday on the estate with a prince of Prussia. Vogt borrowed a forester's uniform and engaged in the chase along with their Highnesses' huntsmen, while the police were searching for him everywhere except within the private domain of the sovereign. The princes returned to their courts, and Vogt, skillfully eluding the guards of the Rhine, escaped to Strasburg and thence to Bern.

Vogt interested himself in Strasburg in visiting the hospitals, where he found many political refugees, and in studying at the libraries and museums zoölogy and fossil forms till his father called him to Bern to assist him. With his natural taste for surgery went a sensitive nature which could not bear to witness the pain attendant upon operations in those days before anæsthetic and other humane appliances were introduced. He took up other branches and became a pupil of Prof. G. Valentin, author of the present physiological theory of the nerves and organs of the senses. He received his degree with honor at twenty-one years of age, and locked his diploma in a trunk which was deposited in the garret. He was proud, however, when his two completed memoirs on the Nerves of Reptiles won the praises of Karl Ernst von Bauer and of Humboldt. They were based upon a collection of American reptiles which Humboldt had left at Valentin's institute.

Louis Agassiz, a frequent visitor at Wilhelm Vogt's, wanted Carl in 1838 to assist him at Neufchâtel, but was introduced to Edouard Desor, then seeking employment, and took him. Carl followed a few months afterward. Agassiz, interested in the study of fresh-water fishes and living and fossil echinoderms, had fitted up

a lodge on the shore of the lake, where Desor and Vogt were installed to carry on the investigations. Vogt composed here the anatomical part of Desor's work on Fossil Fishes, the Fishes of the Old Red Sandstone, and the German edition of Studies of Glaciers.

The controversy concerning glacial action was at its height. A theory had been proposed of an immense glacier having once occupied the Rhône Valley above Martigny, but Agassiz was still doubtful about it. He, with Desor, had visited the principal glacial fields of the Alps, and conceived a plan for studying a glacier continuously. In 1839 a party of about a dozen students, of whom Agassiz, Desor, Vogt, and Pourtales are best known to Americans, with guides and porters, established themselves by the lower glacier of the Aar, where they could watch its inner life. A suitable camping place was found by the side of an immense boulder, and a lodge was instituted and given the name of the Hôtel des Neuchatelois. The hôtel was much visited during the four years, the students occupied it by guests, many of whom became illustrious in science. Vogt's first book, *Im Gebirg und auf den Gletschern*, embodying his experiences there, was published in 1842.

The new glacial theory was still bitterly opposed, and by no one with more vigor than Leopold von Buch. It fell to Vogt to defend it before the German scientific meeting at Erlangen in 1840, and then at Mayence, both times in von Buch's presence. His expositions were interrupted by frequent objections from von Buch, who replied with all his force. Vogt, paying no attention to invectives and sarcasms of his antagonist, simply exposed the insufficiency of his arguments, and concluded with a protest against the road to free inquiry being barred by the mischievous principle of authority in science. He won the day. Shortly after this Vogt and Agassiz differed on a question concerning the award of credit for discoveries and publications and separated.

Vogt spent three years in Paris, working busily and producing many zoölogical and biological memoirs; published his Text-book of Geology and Petrifications, and figured prominently in the formation of the Society of German Physicians, which has become a very important body. In the text-book he expressed doubts concerning the theory of a fluid nucleus within the earth, which everybody held then. Vogt's fame reached the general public through his *Physiologische Briefe*, a book which brought the science within the comprehension of the ordinary reader, while it was still welcome to the professional man. It treated the subject of generation with a plainness that had not been ventured upon in any other popular work; and it attacked the doctrine of the survival of the soul, affirming, in effect, that all the properties designated as mental activity

are simply functions of the cerebral substance. It was condemned by the ecclesiastics and was the subject of controversies in the German universities. On one of his journeys his attention was drawn, by witnessing the operation of the fishermen, to the Bay of Villafranca as a suitable station for zoölogical research. He fixed a laboratory there and set down to work. In a short time he was invited by Liebig to return to Giessen as professor of geology. The officials at Darmstadt, recollecting his revolutionary proclivities, opposed and delayed his confirmation, bringing all manner of objections against him, and among them that he had opposed von Buch and ridiculed his theories. Von Buch, however, attested to his fitness for the position; Humboldt recommended him, and he was appointed in December, 1846, and took his position in April, 1847. He delivered and published his inaugural address, *On the Present Condition of the Descriptive Sciences*; translated Desor's *Geological Excursions*; published his *Ocean and Mediterranean*; and had just completed the arrangement of his Zoölogical Laboratory when the revolutions of 1848 broke out. He was chosen to represent Giessen at the Congress of Deputies, or *Vor Parlament*, which met at Frankfort, March 31st, and again at the German Parliament of May 18th. He wrote vigorous articles for the liberal journals; and when the Parliament was driven to Stuttgart in May, 1849, he was named one of the five regents of the empire, to whom discretionary powers were given. When Stuttgart was placed under siege he retired to Bern, where, as a member of the Committee of Assistance, he succored political refugees of all countries. When the throng of refugees had thinned out, Professor Vogt made another sojourn at Villafranca and published studies of the siphonophores and tunicates or salpæ, issued two or three political satires under scientific disguises, translated the *Vestiges of Creation*, and published the *Zoologische Briefe*, a book which became a necessity to students.

In March, 1852, M. A. Tourte, Superintendent of Public Instruction in Geneva, offered Professor Vogt the chair of botany in the academy there. The offer was declined, botany not being a specialty of Vogt's, and he was offered geology and paleontology with embryology. He made himself felt in the life and fortunes of the city, and rendered valuable service to Geneva and Switzerland. He was consulted as a geological expert in the building of the railroads of the country; was interested in the first conception of the St. Gothard Tunnel, which was pierced years afterward under the direction of another Genevan; he assisted in the foundation of the National Institute of Science, Letters, Fine Arts, and Agriculture, and was its president for a quarter of a century; he sat at different times, twenty-one years in all, in the Grand Council of the Canton

of Geneva, the Council of Swiss States, and the National Council; and he exerted a strong personal influence in political affairs.

Professor Vogt labored earnestly to promote the establishment of marine zoölogical laboratories, as well as of smaller stations, and sought to enlist the co-operation in the scheme of friends in high places in different countries. His efforts in behalf of this cause continued through forty years, his first letter on the subject having been written in 1855, and his last in 1894.

The theory suggested in Darwin's *Origin of Species* fell in well with Professor Vogt's views, as they may be found expressed in citations from his writings as far back as the *Embryology of the Salmon*, in 1842. Yet, as M. Quatrefages has shown in his *Emules de Darwin*, he did not agree with that author in all points. Divergences between the two are shown in Vogt's study of the *Archæopteryx* and in articles published in French and German reviews and issued afterward in separate form.

In May, 1861, Professor Vogt went, on the invitation of Dr. Berna, of Frankfort, upon a voyage to the northern seas in the brig Joachim Heinrich. Besides these two, Gressley, the erratic geologist, Hasselhorst, the painter, and Alexander Herzen, the younger, were of the party. Having visited the North Cape, they proceeded to Jan Mayen, an island whose ice-bound coasts had baffled many a sailor and explorers of high rank, and which was still nearly unknown. They effected a landing and examined the whole rock. They then went to Iceland, where the capital was decorated in their honor, and started for home on the 15th of September. Professor Vogt's book descriptive of this voyage was published in October, 1862.

The special characteristic of the *Vorlesungen über den Menschen*—Lectures on Man—1862-'63, which was translated into several languages, was its presentation for the first time in the concrete, and compactly, of the fundamental data of anthropology and its insistence upon the anatomical relations of man with the lower animals. It played a prominent part in the controversies of the next ten years over materialism. A less serious work was the translation of Brillat Savarin's *Physiology of Taste*, in recognition of which the translator was made honorary president of the Society of Cooks of Munich. The discoveries of the flint implements, the relics of man in caves, and the lake dwellings were the subject of several memoirs by Professor Vogt, and he projected a complete work upon them, but was never able to prepare it. His last paper on the subject was one respecting the bones of the *Pithecanthropus erectus*, which was published in a Frankfort journal two months previous to his death.

In 1864-'66 Professor Vogt published a collection of lectures on injurious and useful animals, embodying one of the earliest pleas for the birds, and for which he received a silver medal and a testimonial letter from the Paris Society for the Protection of Animals; and a memoir on those curiously deformed human beings (of which the "Aztec children" of the showmen were specimens) called "micro-cephales" or man-monkeys. He regarded the defects in structure of these creatures as phenomena of atavism, or reversion to the structure of simian ancestors—man in body, monkey in mind. The publication was the occasion of bitter controversies.

This added to his fame, and when, in 1867, he started on a lecture tour in Germany, Austria, and Belgium, he met large audiences. The purpose of his lectures was to make a popular presentation of the Darwinian principles and to vindicate freedom of inquiry. The theory of the man-monkey was formally and earnestly discussed, at the Prehistoric Congress held at Copenhagen in 1869, between Professors Vogt and Quatrefages. Vogt, with Virchow, Fraas, Ecker, and others, at this time took the first steps toward the formation of the German Anthropological Society; and the first volume of the *Archiv für Anthropologie* contained an article by Vogt on the Primitive Times of the Human Race.

During the Franco-German War of 1870 Vogt's sympathies were with France, and he opposed the German annexation of Alsace-Lorraine. This caused a temporary estrangement between him and his German friends. The unpleasant feeling gradually passed away, and when, in 1871, the Congress of Prehistoric Archaeology and Anthropology met at Bologna in connection with the celebration of the eight hundredth anniversary of the university, he was relied upon to temper the hostility between the French and German professors, who had carried their political animosities into their science.

One of the most curious incidents of Professor Vogt's life, considering what a freethinker he was, was his defense of the Roman Catholic schools in Geneva against a bill depriving them of privileges which were still left to the Protestants and Jews. The bishop asked his influence in the matter, saying in his letter that notwithstanding their differences on all common questions, he recognized Vogt as the impartial champion of the liberties of all. This act caused a separation of Vogt from the majority of his party on the question and aroused some animosity, culminating in an unsuccessful effort to disturb his position in the academy. Shortly afterward a faculty of medicine was created, and the academy was raised to the rank of a university. Professor Vogt was active in the efforts that were used toward making the institution worthy of its name and providing it with a suitable building. His lectures to his classes are described

as having been carefully prepared, with every detail of substance and illustration faithfully looked after, and as excelling in the quality of making arduous questions understandable to all. He translated into French Gegenbaur's Manual of Comparative Anatomy, published his Atlas of Zoölogy, and, studying life at the seaside in his vacations, wrote those charming articles, making his name familiar to readers of all classes, which appeared from time to time in various German popular periodicals. He was commissioned by the Genevan Government to investigate the phylloxera and report upon it. He defended vivisection and charged its opponents with committing the cruelties they denounced. Did they not patronize the stock raisers who mutilated their animals to make them fatter and more pleasant to the taste; and feast on fish which had been tortured in catching; and ride behind mutilated horses?

Professor Vogt's memoir on the Archæopteryx is one of the most important documents in the discussion which defined that fossil as marking a notable stage in the transition from the avian to the reptilian form. When, in 1880, Dr. Hahn speculated on the presence of organic growths in meteorites, Professor Vogt exposed the fallacies of his conclusions; and in a second memoir he and Dennis Monier, professor of chemistry, showed with proofs from their own experiments that all the essential features of Hahn's meteoric fossils could be artificially produced with inorganic substances. He protested against the extension and predominance of militarism; contended against overloading youth with school duties; advocated a rational system of school hygiene; and opposed the study of Greek and Latin.

Vogt's Mammals, published at Munich near the beginning of 1884, with numerous plates and illustrations, was written in a pleasant style, and made most prominent the habits and the geographical distribution of animals.

The Treatise on Practical Comparative Anatomy was published after eight years of preparation, with the names of Carl Vogt and Emil Yung as joint authors, and acknowledgments to Dr. Jacquet.

As infirmity began to grow upon him, Professor Vogt tried the injections of Brown-Séquard's elixir, from which he enjoyed a temporary invigoration, and described the experiment in the *Frankfurter Zeitung*.

The last work he contemplated was a Treatise on the Fishes of Central Europe, which, with the assistance of M. Grote, of Barmen, was to be magnificently illustrated. He did not live to finish it.

On May 4, 1895, after Professor Vogt had suffered long from insomnia, his doctor gave him an injection of morphine. He at once fell asleep, but never woke, and at five o'clock the next afternoon his heart ceased to beat.

Editor's Table.

ARE THE AMERICAN PEOPLE CIVILIZED?

TO most persons such a question will seem very absurd. Of course, the American people are civilized. They are probably the most civilized on the face of the earth, not in a material sense merely but in an immaterial sense. Where is there more anxious discussion of ways and means to elevate the condition of the poor both morally and physically, and to alleviate the sufferings of the unfortunate? Where is there so much money given to promote the work of charity and education? But the sympathies of the American people are not confined to their own borders. When there is a great calamity abroad, like an Irish or Russian famine, or an Indian plague, no purse is opened more quickly or widely than theirs; and as to work in the missionary field, have they not contributed countless sums to carry it on?

But these statements betray an inexact knowledge of the essence of civilization. They show how the mind is taken with the ostentatious and dazzling, which may possess a meaning quite different from that attached to them, and how it fails to grasp the more significant but hardly less obvious phenomena of American social and political life. Charity does not necessarily mean a high civilization, for it may be born of vanity, a conspicuous trait of the barbarian, and be so shortsighted as to be utterly destructive of the best interests of the race. Nor does education in the popular sense—that is, the acquisition of facts and the sharpening of the intellect—mean civilization proper, for, as Mr. Mor-

ley pointed out in his recent lecture on Machiavelli, rare scholarship and a high degree of æsthetic taste, such as those of the Medici and their associates, may be coupled with unspeakable baseness. The truly civilized man does not refrain simply from conduct that is clearly wrong, such as robbery and murder, but he refrains from conduct that tends in indirect and obscure ways to injure his fellows, depriving them in the long run of their lives and their property. His sympathies are lively in the highest degree. But they are rational. While they respond to immediate suffering, they respond more quickly to the greater remote suffering that unwise philanthropy always inflicts. While, finally, he is resentful of invasions of his own rights, he is invariably considerate and jealous of the rights of others.

When judged by this standard, one that a few persons in every community have already reached, the American people can hardly be said to have attained civilization. In fact, they are, in many respects, still on the level of barbarians, deficient in self-control, oblivious to the rights and feelings of others, incapable of grasping the less obvious but more important results of a given line of conduct, and even given over to actual lawlessness and crime. They may shudder at Armenian massacres, and feel that the Turk deserves the solicitude of the hangman. They may denounce with a Carlylean wealth of epithet the Spanish cruelties in Cuba, which are, in reality, nothing more than the inevitable accompaniment of war, and clamor for an intervention that will put an end to them in the interest of humanity.

But have they earned the right to set themselves up as international philanthropists, when their own hearthstone, according to Dr. Andrew D. White, is made red every year with the blood of more than ten thousand victims of the homicide? Do their generous contributions to domestic charities and foreign missions entitle them to distinction as model representatives of Christian civilization, when mobs of leading citizens in New York and Ohio, as well as in various Southern States, lynch negroes charged with crimes that have not been proved? Has not Christian civilization some conquests to make in a land where, as in New Orleans, Italians are murdered with the approval of public sentiment, and, as in many parts of the West, the treatment of Chinese is hardly less savage than that of European missionaries in the most benighted districts of the Celestial Empire? Is it not clear also that barbarism has yet to be abolished where striking workingmen burn down property and assail the men ready to take their places with a ferocity that the followers of Attila might have envied?

But it is not such obvious facts as these that justify the sneering smile of the cynic at the patriotic boast of Americans in regard to their civilization. Certain conspicuous features of our public policy are not less indicative of the tastes and instincts of a barbarian. Take, for one example, the provision of the Constitution of the State of New York that restricts prison labor. Had the convention that framed it proposed that, in order to relieve the Commonwealth of its criminal burden, a certain number of prisoners should be strangled every month, what an outburst of horror throughout the country there would have been! But the provision actually adopted by the picked repre-

sentatives of the people and afterward approved by the people themselves is hardly less atrocious. The idleness it enforces is driving prisoners mad. Yet there is more effort to stop cruelty to animals and to throttle science by putting an end to vivisection than there is to suppress this form of atrocity. Take, for another example, the law recently passed that will either enhance the price or vitiate the quality of every commodity on which a protective duty is levied. A people really civilized could no more have permitted it to be placed on the statute books than they could permit thieves to rob the poor of a part of their food and clothing, making it more difficult for them to live and thus increasing the suffering that philanthropists and social reformers are seeking in endless ways to alleviate. It would have seemed to them nothing less than barbarous to pass a law that not only makes it more difficult for their own countrymen to live, but deprives people in foreign countries, like the Welsh tinsmiths and the Austrian pearl-button makers, of a means of livelihood. Take, for still another example, the imperfect international copyright law. People that appreciate in but a very indistinct manner the existence of property in ideas and refuse to protect it effectively do not meet the requirements of the definition of civilization.

But the policy of aggression, which is the more fit term that Mr. Spencer applies to what is called protection, a policy inherited directly from feudal barbarism, is not confined to tariff laws and imperfect international copyright laws; it extends to the innumerable laws passed by State and national Legislatures in restriction of personal liberty and in authorization of the seizure of private property for purposes outside of the legitimate sphere of government.

Money taken from a man for an object that he does not approve, such as circulating libraries, public baths, and a hundred and one other schemes supposed to be for the benefit of people, is as much a violation of the principle of equal rights, the unfailing test of a high civilization, as the highwayman's possession of a traveler's purse. The same is true of taxes in support of so-called public charities, which are not charities at all, properly speaking. They are simply compulsory largesses, since they are not voluntary contributions prompted by the altruism of the citizen, but forced contributions that he is always glad to escape.

So enormously has this policy of aggression grown within the past few years; so indifferent have people become to the fundamental duty of human society, namely, the maintenance of order and the enforcement of justice; little wonder that "a spirited foreign policy" is now one of the most cherished ideals of the American people. It is only an extension of the domestic aggression to the field of foreign politics. People that violate incessantly and without the slightest compunction the rights of one another, no matter what fine motives they may give themselves in justification, are certain to be deficient in respect for the rights of the foreigner. Not in a negative way alone by the passage of tariff and anti-immigration acts will they attack him. But they will attack him positively, issuing blustering declarations of defiance and insult, proposing the violation of the laws of nations in order to interfere in behalf of rebellious subjects, conniving at conspiracies to overthrow a monarchical government in the interest of a more democratic one, and making elaborate preparations on land and sea to engage in any conflict that may be provoked.

The induction to be made from an examination of these phenomena of American social and political life is obvious. It is that we shall never reach the highest civilization by the path that we are pursuing so energetically and with so much self-satisfaction. A continuance of the policy of aggression, both domestic and foreign, can not fail to end disastrously. Devotion to the work of perfecting our criminal laws and the suppression of crime; to the simplification of our civil laws, making justice cheap and easy; and to the redemption of our various governments from the pilferers that have taken possession of them, may not appeal very powerfully to the imagination of men intent on great and showy schemes of state philanthropy. But it will do infinitely more to promote American civilization. It will teach men to respect the rights of others, and to do nothing that will violate even remotely the principle of justice. It will lead them to depend upon themselves—that is, voluntary co-operation, instead of the state—that is, compulsory co-operation—to promote the schemes of the philanthropist for the alleviation of human suffering and the advancement of the human race.

ABSTRACTIONS IN EDUCATION.

A RECENT article by Mr. Frederick Burk in the *Atlantic Monthly* gives a vivid idea of the uselessness and worse than uselessness of much of the instruction that is imparted to normal-school classes under the head of Psychology and Methods of Education. Mr. Burk has been attending classes in several of the foremost institutions for the training of teachers, and furnishes verbatim reports of what he heard. As we think it of importance that attention should be called as widely as possible to his

observations and conclusions, we shall here quote portions of his article.

In one normal school the question under discussion in the psychology class was as to the nature and authority of conscience, and the question having been asked, Is conscience an infallible guide? the following answer was accepted as correct: "In one sense conscience is infallible and in another it is not. Conscience is not infallible in judging what is the highest good; it is infallible in affirming that we should choose in accordance with our sense of obligation." According to this definition, we have, over and above a "sense of obligation" in moral matters, something which tells us we should obey that sense. But if a "sense of obligation" does not of itself imply a need for obedience, what force is there in the words? And what could be more palpably redundant in expression than to say that conscience is that which makes us feel that *we must do what we feel we must do*? Yet such and no other is the sense of the answer accepted as correct.

There was more to come, however. The fallibility of conscience in indicating the right course to follow having been admitted, and the consequent diversity of human standards of conduct having been recognized, the teacher asked whether there was any such thing as an absolute standard. The class answered "Yes," and being asked to say where such a standard was to be found, answered with great unanimity, "In the Word of God." Teacher: "The Word of God, then, makes a revelation of God's will and gives us a standard of absolute right?" Class: "Yes, sir." It might have been expected that at this point the question would have been raised as to how it was that human standards differed

so greatly if there was one generally accepted standard in the Word of God; but obvious as this development of the subject was, the discussion broke off at this point save for an objection raised by one of the pupils to the effect that, if the Bible contained the one true standard of right conduct, nations that did not possess it could not know what they ought to do. This objection the teacher disposed of by authoritatively stating that *we* were in no uncertainty, and that the other matter might rest.

Now, if the object of this discussion was in any degree to teach the teachers of the future to *think*, we can only say that they were not fairly dealt with. Every one knows that disputes in regard to questions of duty constantly arise and sometimes wax very sharp between parties who equally recognize the authority of the Bible. If there is one absolute standard in the Bible, why should there be so many conflicting human standards, and why should the conscience of those who accept the Bible frequently lead them astray as seemed to be fully admitted in the class? When our slavery troubles were at their height, was not the Bible invoked with equal conviction on both sides? Did not difference of opinion as to what the Bible taught on the subject lead even to the disruption of churches? To-day legal prohibition of the liquor traffic is a leading issue; and the situation is just the same as it was forty years ago in regard to slavery. Some find prohibition in the Bible; others find a distinct recognition of the lawfulness of wine drinking. So with the question of women's rights, the question of capital punishment, and a dozen others that might be named. For every text which the advocates of one theory can quote, their opponents are ready with one of seemingly opposite import. These are facts

sufficiently notorious to be well within the knowledge of normal students, and therefore to tell such students without qualification that the Bible contained the one absolute standard of right was simply casting dust in their eyes. It is of prime importance that the teachers of the future should be taught to be honest in their intellectual methods, but here was a direct lesson—so at least we regard it—in dishonesty. The moral is, when a discussion threatens to develop in a “dangerous” direction, cut it short or shunt it on to another track. We should not teach that to normal students; we should not teach it to anybody. We may properly teach caution in dealing with difficult subjects, and may point out the errors to which logical processes are always liable; but we should never inculcate the duty of closing the eyes to unwelcome facts. The cause of the Bible is not served by those who put forward conventional views in regard to it and seek to exempt these from criticism. Like all else that is good, the Bible only gains in influence and just authority through being represented simply as it is.

In the same school, the subject of the will being under discussion, the teacher inquired how the will was cultivated. The answer given—correct, we are informed, according to the book—was as follows: “The will is cultivated by cultivating the intellect, which enables the mind to judge more wisely what is the highest good; by listening to the voice of conscience in regulating the natural impulses; by resolving to do always what ought to be done.” It seems wonderful that the futility of such talk is not self-evident. If the object was to teach the students how to use words without meaning anything by them we should think this particular exercise well chosen. We are to cultivate the

will “by listening to the voice of conscience in regulating the impulses,” and “by resolving to do always what ought to be done.” But people who can “listen to the voice of conscience” so as to control their impulses, and who are capable of “resolving to do always what ought to be done,” have their will already cultivated: we do not see what more they want. Then surely the teacher who approved of the statement that by cultivating the intellect we enable the mind to judge more wisely what is the highest good must have forgotten that only a short time before he had taught the class that the Word of God contained the one perfect standard of right action. What is the use of cultivating our intellects in order to find out what is fully set forth for our guidance in a book accessible to all? A standard once given is something to use, not to dispute about.

We must, however, quote verbatim Mr. Burk's experience in another school.

One recitation that I heard was upon the formation of judgments.

“What is a judgment?” asked the teacher, as he picked off a card from a pack containing the names of the members of the class.

“A judgment,” replied the pupil upon whom the lot fell, “is a relation between concepts.”

“What is the act of judging?” was asked as a fresh card was turned.

“The act of judging,” said the pupil, “is the act of knowing that the concept of the species is included in the concept of the genus.”

“Give an example.”

“In the judgment ‘a dog is an animal,’ the act of judging is the act of knowing that the concept ‘dog’ is included in the concept ‘animal.’”

“In what two ways may concepts be compared?”

“Concepts may be compared in two ways—as to content and as to extent.”

“What is a judgment of content?”

“A judgment of content is the knowing that the content of one judgment is included in the content of another.”

The wording of this answer was not considered quite correct by the attentive class, and a correction was made.

"What two kinds of judgment of extent are there?" asked the teacher.

"The two kinds of judgment of extent are common judgments of extent and scientific judgments of extent."

"What is a common judgment of extent?" and the turning of the card brought to her feet a ruddy-faced young woman, who said with considerable rapidity, "A common judgment of extent is the knowing that one judgment of extent is included in the concept of another, without *genii* or *species*."

A titter admonished her, and she hastily corrected her statement: "I mean, without *genii* or *speciei*."

The answer finally accepted as correct was that "a common judgment of extent is the knowing that one judgment of extent is included in the judgment of another without being included as a species of the genus."

Is it not lamentable to think that, in these days, when science is giving so real a character to human knowledge, such unprofitable verbiage as the above should still be foisted upon the minds of students in our most reputable educational institutions? As Mr. Burk very well points out, the sciences of biology and anthropology have revealed the mind as something subject to definite though very complex laws of growth, and have completely overturned the mediæval conception of it as a thing organized and partitioned off according to the methods of thought of adult and fully self-conscious human beings. All questions therefore relating to conscience, will, and judgment should, in relation to education at least, be considered as questions of phase in a developing organism, not as questions of hard fact in a fully and finally developed system. It is satisfactory to learn that in one or two institutions Mr. Burk found the modern point of view fairly well recognized. We hope his article will

hasten a much-needed change in pedagogic methods.

POLITICAL BOSSISM.

In former days people used to grow restive periodically under the abuses of monarchical or autocratic government; and there were those who fondly believed that, if monarchy as an institution could be done away with and the people left free to govern themselves, all political troubles would cease. Well, in certain countries, and notably in this, every vestige of monarchy in the hereditary sense has been abolished; the people are free to govern themselves; and yet, judging by the discussions that we read in the daily press, the golden age seems still to delay its coming. The complaint used to be that the monarch was forgetful of the true interests of his subjects, that too much was sacrificed to court intrigues and private favoritism; and, strange to say, we hear to-day complaints which run on precisely the same lines, though directed against quite another class of authorities. Instead of the intrigues of a court we have the intrigues of committees and their managers; and just as before, but perhaps to an even greater extent, the people find that their real interests are being neglected while their supposed servants, but actual rulers, are assigning places and carving out the public wealth with a view mainly to their own convenience and the perpetuation of their power. At the present moment there is in this very community a specially bitter outcry against the evils of political bossism, and thousands of worthy citizens have taken counsel together in the hope of casting asunder the bands which they find so oppressive. If they can by a prodigious effort break the power of the ruling boss, things,

they hope, will go better ever afterwards. We are not sure that there is not some illusion in this. No monarch ever placed himself on his throne by his own unaided action; and no boss ever acquired his position by the sole exertion of his own will. The origin of the boss, as we take it, is this: Government with all its powers being thrown into the hands of the people, there arises a keen struggle as to who shall wield those powers and enjoy such advantages as may be incident thereto. Such a struggle necessarily develops into a faction fight; and where there is fighting there must be organization for fighting purposes. The boss is the leader of the faction, the man who surveys with a comprehensive eye the whole field of battle, who enforces discipline, who gives the word of command, who directs the campaign. The old saying that in the midst of arms laws must keep silent is verified in these political struggles. The place which ought to be filled by some competent man prepared to serve the public to the utmost of his ability has to be given to some one whose appointment will "strengthen the party"; and the party is understood to be strengthened when an important office is bestowed in such a manner as (1) to encourage party workers, and (2) to furnish funds for party uses. Neither in actual warfare nor in politics are battles won by discourses on moral philosophy. The boss engages to carry his party to victory, or to nurse its energies after defeat; and he must be allowed a large discretion as to the means to be used.

A little reflection, therefore, will make it clear that the only way to get rid of the boss is to do away with the necessity for his services. As long as he is wanted he will be there, and there is very little use in finding fault with him or with his methods.

As well find fault with a general in the field for shelling a town in which the enemy have fortified themselves, or setting fire to standing grain, or doing any other of the thousand wasteful acts that characterize ordinary warfare. War is war the world over, and—bloodshed apart, which, however, may not be far in the background—political warfare has all the signs and characteristics of war in its murderous form. It is a matter of strategy. It involves waste of property, and gains its ends, whenever necessary, by ruse and deceit. The question how to get rid of the boss is merged, therefore, in the much wider one, how to get rid of the conflict that calls the boss into existence and invests him with dictatorial power.

There is but one way that we can see, and that is to persuade the electorate that appointments to office are not things to squabble about, and that, in so far as any man governs through his vote, he is bound to do it in the interest of the country at large. We are not enthusiastic enough to believe that such a change in public sentiment can be brought about in a short time. Still, we consider it important that the seat of the trouble should be distinctly recognized. So long as men are bent on fighting for the control of patronage it is vain to ask them to set aside the leaders upon whose talents for organization, strength of will, and general resourcefulness all their hopes of victory depend. The efforts of reformers should be bent, not on showing how many deplorable acts the different bosses are responsible for, and how little in general they consult the public interest in the exercise of their power, but in bringing home the responsibility for this whole condition of things upon the thousands of electors who never ascend to any correct view of their

political obligations, and consequently never think of using their individual portions of political power for other than selfish ends. The boss	will continue to flourish until the people get a new heart. When that day comes he will pass into innocuous desuetude.
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Scientific Literature.

SPECIAL BOOKS.

THE climatic treatment of disease has assumed an increasing importance during the last decade, and seems destined to become an even more essential factor than the actual exhibition of drugs. Many of our common ills, especially when they occur in large cities, are primarily due to vicious and unhygienic modes of living, so that oftentimes the simple change to other surroundings will effect a cure. Besides all this, however, and the direct stimulus which lies in the change itself, there is now recognized a distinct curative effect in certain sections and climatic conditions for specific diseases. The book before us* is an attempt to study and systematize this subject of medical climatology so that the practitioner may have some scientific groundwork on which to base his advice to the patient. As Dr. Solly says, this sort of advice is constantly asked for, and the ordinary physician, being quite ignorant of anything like systematic knowledge of the subject, often gives directions based on hearsay or medical-journal notes which are, to say the least, not beneficial in results. The book is divided into three general sections. The first of these deals broadly with the principles of medical climatology, and shows the close connection of this science with physics, meteorology, ethnology, and geographical pathology; the second section treats of the therapeutics of climate in relation to disease; and the third section is devoted to a description of special climates as typified in selected resorts, and includes a number of comparative temperature and rainfall tables. This section is by far the largest, occupying about two thirds of the whole book, and about two thirds of this is given to the United States. There is also a brief survey of climatic conditions in Mexico and South America.

The first two sections are obviously chiefly of interest to the practicing physician, although they are so clearly and simply written as to make easy reading for the layman; but the third section, which describes the various climates and the places where they may be found, including a general survey of the comforts obtainable in the way of living accommodations, food, and the recreative possibilities, is of direct interest to the large number of chronic invalids who are looking for a palliation or correction of their symptoms through climatic agencies.

One of the points dwelt on at length is the fact that a by no means just idea of the suitability of a given district can be obtained by a simple study of its rainfall and temperature charts—the question of humidity being of perhaps more importance than either of these factors, not only largely determining its sensible heat and cold but also its insect and plant life.

* *A Handbook of Medical Climatology.* By S. Edwin Solly, M. D. Illustrated. Philadelphia: Lea Brothers and Company. Pp. 470. Price, \$4.

The importance of this subject, and more especially the importance of a knowledge of it by the physician, can not be too much insisted on; and Dr. Solly's attempt to bring the hitherto isolated data into some sort of usable order is worthy of the greatest encouragement. In so large a task, it is not surprising if we find some imperfections in its carrying out. One of these is a general diffuseness—a devotion of considerable space to the statement of facts which every schoolboy might be expected to know, and the defining of such things as weather, clouds, and fogs. These, however, are minor imperfections, and the work seems, as a whole, to be worthy of extreme commendation, although, owing to its attempt to cover the climates and health resorts of the entire world, its treatment of individual places is rather meager. The book contains a number of instructive rainfall and relief maps.

In the form of a story in which the animals talk to one another, President *Jordan* has given a sketch of the life history of the fur seal.* The incidents of the story afford a description of the infancy of the pups, the life of the "bachelors," and the family cares of the "beach masters," or full-grown males, and the females. The various forms in which death comes to the seals are also told—by starvation to the young if their mothers are killed before they are weaned, by the club of the hunter in the drives of bachelors, by cast of the spear to females sleeping on the water, and by old age if all other vicissitudes are safely passed. The story is told in language simple enough to be understood by the young, and it is meaty enough to be of interest to adults. The illustrations equal the text in volume and are not behind it in interest. There are over forty full-page plates from photographs and nearly as many small pen sketches in the text. President *Jordan* was appointed in 1896 chief of a commission from the United States to examine the seal fisheries of the Bering Sea in conjunction with similar commissions from Great Britain and from Canada. This book embodies a part of the information gathered during his first summer on and near the Pribilof Islands.

The beginner who has Prof. *Comstock's* book for a guide can hardly fail to become interested in entomology.† It gives the pupil plenty to do, it explains all difficult matters clearly, its style is animated, and it is further embellished by occasional poetical quotations. Observation in the field and on captive specimens in the schoolroom is the keynote of the book. The opening chapters are of general scope. The first describes the parts of an insect, the second tells how to collect and preserve specimens of each of the chief orders, while the third outlines the classification of insects and their near relatives. The second chapter does not contain all the directions for collecting. Further details on this subject and on the preservation and labeling of specimens, the breeding of insects, and on materials and reference books are given in another division of the volume occupying the last sixty pages. In the descriptive part insects are grouped under the heads of pond, brook, orchard, forest, and roadside life. Pupils are directed to collect eggs for hatching, and larvæ and pupæ to watch

* *Matka and Kotik*. By David Starr Jordan. San Francisco: The Whittaker and Ray Co. Pp. 69, 12mo.

† *Insect Life*. By John Henry Comstock. New York: D. Appleton and Company. Pp. 349, 12mo. Price, \$2.50.

their transformations; also to observe the habits of free insects, and to make drawings of various parts. Two hundred and ninety-six cuts afford material aid in identifying species.

GENERAL NOTICES.

SOME volumes* of what promises to be an unusually valuable series (even in this day of series) have recently come to us in the shape of two little histories—one of England and one of Germany. They are intended to give a brief general outline of the more salient and striking points in the history of each country, and are written so as to attract and appeal to children, with the hope that the interest thus stimulated by these mere outlines will lead the grown-up child to a perusal of the more extended and complete general historical accounts. The idea is a good one, and it seems to have been carried out fairly well in both of the present volumes.

The volume on England begins its story with the landing of Julius Cæsar. The state of things which he found and the changes brought about by the Roman conquest are discussed in the first chapter. The second chapter takes us to the Norman conquest. The chapters are divided up in this way all through the book, more stress being laid on the striking and important events from the standpoint of the whole people than on the lives of kings and the battles they fought. The growth of the Parliament and the several reform acts receive special attention.

German history is practically nothing but the story of a series of wars up to the time of the Reformation. This period is given about ninety pages in the present volume. Louis XIV and the War of the Spanish Succession are told about in the fifth chapter. The Seven Years' War and the fall of Germany during the Napoleonic epoch are next taken up; and finally there are two chapters—one on the German Confederation, and the last one on the modern German Empire as it stands to-day.

This notable work was projected by Dr. von Tuben† to fill a gap in the literature re-

lating to diseases of plants.* It deals with those diseases produced by the cryptogams and other lower organisms of the vegetable kingdom. The large number of parasites which attack such lower plants as algæ and lichens have, as a rule, been omitted. In the general part of the volume, comprising the first hundred pages, parasitism and the relations between parasite and host are discussed from a botanical standpoint. The subject of parasitism is immensely important on the economic side; for the ravages of scab and rust, of blight and smut, are world-wide and often grievous. Our author has not been indifferent to making his studies useful, but has summarized the preventive and combative agencies available against the more important diseases of economic plants. In the second or systematic part of the book the pathological phenomena are considered along with the description of the organism producing them. Notices of greater length are given to such parasites and diseases as have formed the subjects of special investigations. The list is intended to be complete for Germany and the neighboring countries, but includes also many species occurring only in other parts of the world, notably in America. Much valuable material has been made available to the author by the recent publication of several important works on the cryptogams. The three hundred and thirty illustrations are almost exclusively the author's own work, and a large part of them illustrate the habitus of pathological organisms. The English edition is more than a translation. It contains many additions by the author and by the editor, and the species of fungi that have been recorded for Britain and North America are indicated.

In a volume entitled *The Theory of Electricity and Magnetism* Dr. Arthur G. Webster,

* History for Young Readers. Germany, by Kate Freilgrath Kroeker. Pp. 251. England, by Francis E. Cooke. Pp. 358. Both, New York: D. Appleton and Company. Price, 60 cents each.

† Diseases of Plants induced by Cryptogamic Parasites. By Dr. Karl Freiherr von Tuben†. English edition by William G. Smith, B. Sc., Ph. D. Longmans, Green & Co.: London, New York, and Bombay. Pp. 598, 8vo. Price, \$5.50 net.

of Clark University, has endeavored to present the mathematics of the subject in a form more assimilable by the student than has been available heretofore (Macmillan, \$3.50). Since graduates of American colleges are, as a rule, insufficiently prepared for taking up mathematical physics, the author has prefixed a mathematical introduction and a treatment of the Newtonian potential function to this work. For a similar reason he has included a treatment of the fundamental principles of mechanics. These matters occupy nearly half of the volume. Little or no reference has been made to experimental methods in electricity, these being left to other works. The general purpose of the treatise is to present the results of the electrical theory as it stands to-day, after the labors of Faraday, Maxwell, Helmholtz, Hertz, and Heaviside.

The *Bulletin of the Department of Labor* for May, 1897 (No. 10), contains a statistical report of one hundred and twelve pages on the Condition of the Negro in Various Cities. The investigation which furnished the data for this report was originally undertaken to ascertain the causes of the excessive mortality of negroes in Chattanooga, Savannah, and Boston. Afterward it was extended to seventeen Southern cities and the city of Cambridge, Mass., and besides statistics of sickness and mortality it has been made to embrace facts concerning sizes of families, number of rooms occupied, rents paid, sanitary condition of houses, occupations, earnings, and the number of defective, maimed, and deformed persons. The statistics do not cover the whole of the cities in which the investigation was made. A representative group of houses was taken in each, as the persons who gave their time to the work could not do more. This bulletin contains also a comparison of figures as to the work of men, women, and children for periods ten years apart, and miscellaneous minor articles.

Volume XXVIII, Part I, of the Harvard Observatory Annals is a catalogue of *Spectra of Bright Stars* discussed by *Antonia C. Maury*. The spectra of six hundred and eighty-one of the brightest stars north of declination -30° , of which about forty-eight hundred photographs were obtained, are comprised in this catalogue. As the in-

vestigations were made several years ago, they could not take account of the recent discoveries respecting the spectrum of helium, but a discussion of the relation of the spectra of stars of the Orion type to that of helium is contained in supplementary notes. Volume XXXVI of the Annals completes the series of five volumes devoted to *Observations of Stars* by Prof. *William A. Rogers*. A list of errata for the whole series of volumes is included.

In the *Fifteenth Annual Report of the Bureau of Ethnology* the director, after describing the work of the year, proceeds to outline conclusions that have been reached by the bureau in regard to regimentation, the satisfaction of justice, and related matters in savage society. The chief of the accompanying papers is by William H. Holmes, on Stone Implements of the Potomac Chesapeake Tidewater. Extensive deposits of rudely flaked stones are found in and about the city of Washington, and careful study of them has shown that they are on the sites of workshops connected with extensive quarries. From examinations of large quantities of rejectage it has been determined that the product of the flaking operations was a leaf-shaped blade. It was further ascertained that such leaf-shaped blades are to be found on Indian village sites in all parts of the surrounding country. Studies of quarries of other materials in the neighboring high land gave similar results, and in order to round out the subject all known classes of implements have been studied. These studies have not revealed the slightest evidence as to the occupancy of the region by any earlier people than the known Indian tribes. Jesse Walter Fewkes contributes a memoir on The Group of Tusayan Ceremonials called *Katcinas*, which is copiously illustrated with cuts and colored plates showing the masks and other paraphernalia used in these rites. There is a special report on The Repair of Casa Grande Ruin, by Cosmos Mindeleff, and other papers are The Siouan Indians, by W J McGee, and Siouan Sociology, by James O. Dorsev.

The work on *Stones for Building and Decoration*, by *George P. Merrill*, originally published in 1891, now appears in a revised and enlarged edition. Reading matter and

plates amounting to over fifty pages have been inserted here and there throughout the volume, and the whole book has been brought down to date. By these changes the author believes that its usefulness has been very materially increased.

The third volume, completing the college text-book of *Nichols and Franklin* on the *Elements of Physics*, has now been issued (Macmillan, \$1.50 net a volume). About three fourths of the two hundred pages are devoted to light and the rest to sound. The calculation of the lengths and velocities of waves of light, of the positions of the foci of lenses and curved mirrors, and similar mathematical exercises in connection with diffraction, photometry, polarization, and radiation constitute the treatment of the former subject. There is more of description and less of mathematics in the chapters on sound, yet here the numerical values of wave motions and of intervals are made prominent. It may be well to repeat that the work, as a whole, is designed as an advanced text-book for colleges where an elementary course in calculus is taught, and whatever of demonstration, illustration, or discussion may seem needful to supplement the text should be supplied from the knowledge of each instructor using the book.

The varying prominence of the female element in religious conceptions is set forth in *The God Idea of the Ancients*, by *Eliza Burt Gamble* (Putnams). This is one of the lines of inquiry taken up by the author in preparing an earlier work on *The Evolution of Woman*, and her intention was to include its results in that work. In the separate volume in which the material has now been embodied she presents evidence to show that mankind construct their own gods and remodel them from the materials supplied by their own developing culture. She finds sex to have been the fundamental fact not only in the operations of Nature but in the construction of a god; that in an early age woman's influence was in the ascendancy over that of man, and the religion of the time reflected the altruistic female character, but with the rise of male dominion the god idea took on egoistic qualities. Creative power is the keynote of many ancient religions, whether they take the form

of tree, sun, fire, or lingam and yoni worship, and the chief god is represented as male or female, according as man or woman has been regarded as having the more important office in reproduction. The author examines a large number of the ancient religions, and points out the sexual significance of many of their emblems and ceremonies. In two chapters on Christianity a Continuation of Paganism she shows that some of these emblems and ceremonies have been inherited by the Christian religion. The book gives evidence of extended study; it is concisely written, and its statements are well fortified by quotations from authorities.

In *Lectures on Appendicitis* (Putnams) Dr. *Robert T. Morris* has given a general description of this disease, including symptoms, both general and local, and the method of treatment which his own experience has led him to believe the most satisfactory. The preparation of surgeon and patient is the subject of Chapter I. In Chapter II the appendix is described and pictured. Appendicitis, its symptoms and complications, is the subject of Chapter III, and finally in Chapter IV its surgical treatment is taken up. This comprises about half of the book. The remainder consists of a number of unrelated essays on such topics as the action of various solvents on gallstones, the drainage wick, and a last resort hernia operation. Illustrations are freely used.

Water and Public Health, by *James H. Fuertes* (John Wiley & Sons, \$1.50), is an attempt to make a comparative study of the mortality statistics of the principal cities of the world with reference to their water supplies. The undertaking is obviously a large one, and the annual mortality in a city is determined by so many different factors that a comparison based on water supply alone can not fail to be misleading. Notwithstanding this unavoidable incompleteness, however, the book contains some valuable suggestions.

The Development of the Frog's Egg, by *Thomas Hunt Morgan* (Macmillan, \$1.60), is intended as an introduction to experimental embryology. Owing to the wide distribution and rather regular habits, despite its name, of *Rana temporaria*, its eggs are always easy to obtain; and as it has both tenacity of life and suitability for experimental purposes, it has

always been the mainstay of the elementary embryologist. Hence we know more about the processes and transformations by means of which its egg develops than we do about these same occurrences in any other egg; and, as it is believed that the process which goes on in one egg is, in a general way, a counterpart of that which goes on in all other eggs, we can, by studying the development of the frog's egg, get a fairly good idea of the embryology of all the other animals hatched from eggs. This book is a careful microscopic following of the process of development in a frog's egg from the time when the egg is forming to the moment when the young tadpole issues from the jelly membranes. Especial weight, however, is laid on the results of experimental work, tending to modify in various ways the normal process. Illustrations are used wherever they tend to simplify the text.

An essay on *The Psychical Correlation of Religious Emotion and Sexual Desire* has been published by Dr. James Weir, Jr., in a tastefully got up pamphlet. He shows the connection between erato-mania and re-

ligious mania by facts drawn from Greek and Roman history, the history of celibate religious orders, and various anthropological investigations. The author believes that upon this correlation depends, in a great measure, the stability of sexual morality. (The author, Owensboro, Ky.)

Art Education, the True Industrial Education, by W. T. Harris (second edition, Bardeen, 50 cents), is an address delivered before the National Educational Association at the meeting in Nashville in 1889. Dr. Harris contends that "aesthetic education—the cultivation of taste, the acquirement of knowledge on the subject of the origin of the idea of beauty (both its historic origin and the philosophical account of its source in human nature), the practice of producing the outlines of the beautiful by the arts of drawing, painting, and modeling, the criticism of works of art—all these things we must claim form the true foundation of the highest success in the industries of any modern nation." Dr. Harris, with his well-known clear and incisive reasoning, supports this thesis through twenty-two pages.

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Fragments of Science.

Birds and Farm Pests.—Mr. F. E. L. Beal, in a paper on Some Common Birds in their Relation to Agriculture, observes that whether a bird is injurious or beneficial depends almost entirely on what it eats. If crows or blackbirds are seen in numbers about cornfields, or if woodpeckers are noticed at work in an orchard, it is perhaps not surprising that they are accused of doing harm. Careful investigation, however, often shows that they are actually destroying noxious insects, and also that even those which do harm at one season may compensate for it by eating noxious species at another. Insects are eaten at all times by the majority of land birds, and during the breeding season most kinds subsist largely and rear their young exclusively on this food. When in-

sects are unusually plentiful they are eaten by many birds which ordinarily do not touch them. Within certain limits birds feed upon the kind of food that is most accessible. Thus, as a rule, insectivorous birds eat the insects that are most easily obtained, provided they do not have some peculiarly disagreeable property. It is not probable that a bird habitually passes by one kind of insect to look for another that is more appetizing, and there seems little evidence in support of the theory that the selection of food is restricted to any particular species of insect, for it is evident that a bird eats those which by its own method of seeking are most easily obtained. Thus, a ground-feeding bird eats those it finds among the dead leaves and grass; a flycatcher captures en-

tirely different kinds; and the woodpecker and warbler in the tree tops select still others. The practical value of birds in controlling insect pests should be more generally recognized. It may be an easy matter to exterminate the birds in an orchard or grain field, but it is an extremely difficult one to control the insect pests. It is certain, too, that the value of our native sparrows as weed destroyers is not appreciated. Weed seed forms an important item of the winter food of many of these birds, and it is impossible to estimate the immense numbers of noxious weeds which are thus annually destroyed. If birds are protected and encouraged to nest about the farm and garden, they will do their share in destroying noxious insects and weeds; and a few hours spent in putting up boxes for bluebirds, martins, and wrens will prove a good investment.

Kites and Balloons in Meteorology.—

The recent development of the kite for meteorological purposes, Mr. A. Lawrence Roche says in his paper on the subject, has taken place in the United States, while the use of automatic balloons for obtaining data at very great altitudes has hitherto been confined to Europe. Kites appear to have been first applied in meteorology by Alexander Wilson in Glasgow, who in 1749 raised thermometers attached to them into the clouds. Next was Franklin's electrical experiment. Between 1883 and 1885 E. D. Archibald made differential measurements of wind velocity by anemometers raised on kites fifteen hundred feet. In 1885 A. McAdie repeated Franklin's experiment on Blue Hill; and he afterward made other electrical experiments with kites. The invention of light-weight self-recording instruments made it possible to obtain graphic records in the air by means of kites; and the introduction of tailless kites by Mr. Eddy added to their usefulness. The thermograph raised by S. P. Ferguson, of Blue Hill, in August, 1894, was no doubt the first instrument recording continuously and graphically to be raised by kites; and it permitted simultaneous observations to be obtained in the free air and near the ground. This method of studying the meteorological conditions of the free air has ever since been in regular use at the Blue Hill Observatory. Probably the greatest elevation yet attained

by kites, and certainly the highest level to which kites have lifted a meteorograph, is 8,740 feet above Blue Hill. This was accomplished October 8, 1896, by the aid of nine kites, having a total area of 170 square feet, which gave a maximum pull at the ground of about a hundred pounds. The meteorograph remained during several hours higher than a mile, and good records of the indications of the barometer, thermometer, and hygrometer were brought down. More than one hundred records of atmospheric pressure, temperature, and relative humidity of the air, or wind velocity at intermediate heights up to the extreme altitude mentioned have been obtained. Kites furnish a ready and accurate method of measuring the heights of certain low and uniform clouds. Changes of wind direction in the different air strata are determined from the azimuths of the kites. To reach much higher altitudes than three miles unmanned free balloons have been considerably used in France and Germany. These balloons, which carry self-recording apparatus, rise until equilibrium is attained in the rarefied air, when they lose their buoyancy and fall to the earth. Most of them have been recovered, with the instruments and records uninjured.

The Education of an Engineer.—Criticising the present methods of education, especially for qualifying students in mechanical science, Mr. G. F. Deacon asked, in his British Association sectional address, "Are we not in some cases attempting, at too early a stage, the teaching of subjects instead of principles? I mean including the practical working of details which will become the regular work of the student in the office or works of an engineer. . . . I do not say that subject training of this kind at college may not be useful; but we have to consider whether it does not, for the sake of some little anticipation of his office work, divert the attention of the student from the better mastery of those principles which it is so essential for him to grasp at the earliest possible time, and which do not limit his choice in the battle of life to any branch whatever of the profession or business of an engineer, but which, on the contrary, qualify him better to pursue with success whatever branches his inclination or his opportunities

or his means may suggest." The author pointed out as a danger in the usual limitations of compulsory subjects for examinations for certificates and degrees, that in view of them subjects not made compulsory may be neglected, however important to the engineer they may be; and he recommends that a certain very moderate standard in all such subjects should be made compulsory if a certificate of proficiency is to be given in engineering or physical science.

History of Color Photography.—In a recent lecture before the Oxford University Junior Scientific Club, Captain W. de W. Abney gave a very good account of the present state and history of color photography. The first process described was that based on the three-color negatives—three negatives being taken, one through an orange, one through a green, and one through a blue screen. These negatives are developed in the ordinary way, and then viewed through three superposed color screens corresponding with those through which the negatives were taken. This process produces very beautiful results, but is obviously limited in application and is not true color photography. The next process described was that of Dr. Joly, of Dublin, who, basing his work on the same theory of color vision as the preceding, reproduces in color by means of a single negative. The human eye is incapable of separating points or lines which lie very close to one another. Dr. Joly's method utilizes this fact by ruling on a transparent screen lines only one two-hundredth of an inch broad, and very close together, and coloring them alternately red, green, and blue. The negative is taken through this screen, and then developed and viewed through a similarly colored screen, when the picture appears in approximately its natural colors. The viewing differ from the taking screens in both of these processes. The taking screens must not be such as to allow only monochromatic light to pass, but must allow a certain amount of overlapping. The viewing, on the contrary, are made as monochromatic as possible. Instead of using transparencies and colored films, transparent inks may be used to produce pictures by three printings. The oldest process described is that of the production of color by the action

of light itself, or the true color photography. Somewhere about 1847 Becquerel found that if, instead of iodizing a plate, he chlorinized it and then exposed it to white light, it gradually assumed a violet tint; and if in this state he exposed it to the spectrum, he was able to obtain the colors of the spectrum on it. Unfortunately, however, these colors were not permanent, and no method has been devised for fixing them. The last method described by Captain Abney was that of Lippmann, who found that if by means of reflection he obtained stationary waves in the film, on development the silver was deposited between the nodes. On reflecting light from such a "noded" plate the proper light alone was reflected, and the photograph, viewed at a particular angle, appeared in its natural colors. If looked at by transmitted light these photographs have merely the appearance of ordinary transparencies. This method is known as the interference method, because the stationary waves which produce the nodes on the plate are caused by the interference of the normal light vibrations.

Distribution of Species by Man.—The Spread of Species by the Agency of Man was the subject of Chairman L. O. Howard's address before the Botanical Section of the American Association. The author showed that while natural spread had been the rule for centuries, the agency of man has become preponderating with the improvement of commercial intercourse between nations. In the intentional introduction of useful plants and flowering plants from foreign countries species sometimes escape from cultivation and become weeds. The intentional introduction of wild animals has generally been disastrous, as those of the mongoose in Jamaica and Australian flying foxes in California. Accidental introductions have been more powerful in extending the range of species and in changing the character of the plants and animals of a given region than intentional introductions. The era of accidental importations began with the beginning of commerce, and has grown with the growth of commerce. The vast extensions of international trade of recent years, every improvement in rapidity of travel and in safety of carriage of goods of all kinds have increased the opportunities of addi-

tional introductions, until at the present time there is hardly a civilized country which has not firmly established and flourishing within its territory hundreds of species of animals and plants of foreign origin, the time and means of introduction of many of which can not be exactly traced, while of others even the original home can not be ascertained. The paper closed with a suggestion that much may be accomplished by wisely planned and guarded introductions, as in the case of the Australian ladybirds introduced into California and the Sandwich Islands through Albert Kaebele.

Fields for Exploration in South America.

—Mr. J. Scott Keltie showed in his geographical address at the British Association that there is a wider and richer field for exploration in South America than in any other continent—even than in central Africa. Along the great river courses our knowledge is fairly satisfactory, but the immense areas, often densely clad with forests, lying between the rivers, are almost unknown. In Patagonia, a great deal has recently been done by the Argentine Government; still, in the country between Punta Arenas and the Rio Negro we have much to learn; while on the west coast range, with its innumerable fiordlike inlets, its islands, and peninsulas, there is a fine field for the geologist and the physical geographer. Indeed, throughout the whole range of the southern Andes, systematic exploration is wanted. There is an enormous area lying to the east of the northern Andes, and comprehending their eastern slopes, embracing the eastern half of Ecuador and Colombia, southern Venezuela, and much of the country lying between that and northern Venezuela, including many of the upper tributaries of the Amazon and Orinoco, of which our knowledge is of the scantiest. Even the country lying between the Rio Negro and the Atlantic is but little known. There are other great areas, in Brazil and in the northern Chaco, which have been only partially described. A survey and detailed geographical and topographical description of the whole basin of Lake Titicaca is a desideratum.

Screw Propellers and Cavitation.—In a paper recently read at the International Congress of Naval Architects and Marine En-

gineers, by Mr. S. W. Barnaby, we find some interesting data on the above subject. Several years ago the author, in conjunction with Mr. Thornycroft, observed and described this phenomenon of cavitation at high speeds, and suggested that the speed of vessels was approaching a point at which propulsion by screws would become less efficient. If a cavity be formed in any manner in the interior of a mass of water it will tend to become filled with water vapor and with any air which may be in solution, since ebullition takes place at ordinary temperatures in a vacuum. The method used thus far for overcoming this tendency is an increase of propeller-blade surface; in one instance, by increasing the surface forty-five per cent without materially changing the diameter or pitch of the propeller, the same speed (twenty-four knots) was obtained with six hundred and fifty less horse power, and with a decrease of slip to seventeen and a half per cent instead of thirty per cent. The number of revolutions required for twenty-four knots with the screws of small area sufficed to drive the vessel at 28.4 knots when the blade area was increased. The vibration was extreme and dangerous with the narrow blades, but was of a quite normal and unimportant character when the blades were widened. Mr. Barnaby thinks that cavitation will be a source of much trouble in the future. Already it is becoming difficult to obtain the requisite area in screws of "destroyers" without either resorting to an abnormal width of blade or to a larger diameter and pitch ratio than would otherwise be preferable. The one expedient gives undue surface friction, and the other necessitates a reduction in the rate of revolution, and therefore a heavier engine.

Pure and Commercial Science.—It should hardly need saying, as Prof. H. Marshall Ward observes in his British Association sectional address, that the fact that a scientific discovery is found to have a commercial value is no argument against the scientific value of the research; yet some are disposed to depreciate research that may advance economical ends. There are in agriculture, forestry, and commerce generally, Prof. Ward continues, "innumerable and important questions for solution, the investigation of which

will need all the powers of careful observation and industrious recording of which a scientific man is capable. But while I emphatically regard these and similar problems as worthy the attention of botanists, and recognize frankly their commercial importance, I want carefully and distinctly to warn all my hearers against supposing that their solution should be attempted simply because they have a commercial value. It is because they are so full of promise as scientific problems that I think it no valid argument against their importance to theoretical science that they have been suggested in practice. In all these matters it seems to me we should recognize that practical men are doing us a service in setting questions, because they set them definitely. In the attempt to solve these problems we may be sure science will gain, and if commerce gains also, so much the better for commerce and indefinitely for us. But that is not the same thing as directly interesting ourselves in the commercial value of the answer. This is not our function, and our advice and researches are more valuable to commerce the less we are concerned with it."

Some New Facts regarding Yeast.—Some interesting experiments have been under way during the past few years regarding the phenomena of fermentation. It has been generally thought that the alcoholic fermentation of sugar by yeast differs from the ordinary hydrolytic processes of the enzymes in that the actual presence of the living yeast cell was an essential. Some investigators have doubted this, however, and have thought that alcoholic fermentation was simply an example of ordinary enzyme action of special complexity. These views were partially supported by some experiments of Dr. E. Buchner, announced in the early spring; and it is now reported that later experiments from the same laboratory still further confirm this view, and, in fact, make it almost a certainty. Dr. Buchner, by pounding up pure yeast with quartz sand and adding a certain amount of water, was able to squeeze out under a pressure of from four hundred to five hundred atmospheres a liquid which, after thorough filtering, was of an opalescent appearance and possessed an agreeable yeastlike odor. All care was taken to exclude any organism from

the liquid, and it was found that under these conditions it was able to excite alcoholic fermentation in solutions of suitable sugars. The addition of chloroform, even up to the saturation point, does not inhibit the fermentative process, and this, in conjunction with the fact that the activity of the solution is not affected by the presence of the ordinary antiseptic substances, and that the solid residue, after evaporation at low temperatures, is found to yield an active solution even after being kept for two or three weeks, seems to show conclusively that the fermentation in these cases is not brought about by living protoplasm in any form, but is really due to an enzyme ferment which the author calls *zymase*. This is further confirmed by the fact that dried yeast heated to 100° for six hours, while incapable of further development, still yields an active solution when treated with a sterilized thirty-seven-per-cent sugar solution.

Thirteen Years' Progress in Physiology.

—The presidential address of Prof. Michael Foster in the Physiological Section of the British Association was devoted to a review of the progress of physiology during the thirteen years since the association previously met in Canada, and dealt largely in technicalities. The progress consists partly of the continuation of investigations previously begun, and of advance in investigations newly entered upon. An example of the former kind is the study of the mechanics of the circulation. The researches of Hürthle and Tigerstedt, of Roy and Adami, and others have left us wiser on this subject than before. So real, if not exciting, progress has been made with the problems of muscular contraction; we are some steps measurably nearer an understanding of what is the nature of the fundamental changes that bring about contraction, and what are the relations in the changes in the structure of muscular fiber. In respect to the beat of the heart, we have continued to approach nearer to the full light. Among other problems concerning which knowledge has advanced are those of the nature of secretion and of transudation, concerning which controversies have raged that have not been wholly unprofitable. Included in the new subjects of research are physiological chemistry in gen-

eral, the nature and office of the secretions, the nervous system, and the workings of the brain—concerning which, “if increasing knowledge gives us increasing power so to mold a muscular fiber that it shall play to the best the part which it has to ply in life, the little knowledge we at present possess gives us at least as much confidence in a coming far greater power over the nerve cell.”

The Tilting of the Lake Region.—The discussion of the geological history and future of the region of the Great Lakes was again brought up in the American Association by Dr. W. J. Spencer, who, after reviewing his investigations in former years of the ancient outlets of Lake Erie, spoke of the lake region as having been covered subsequently to the Glacial period by great bodies of water all at one level. One of these, Warren Gulf, which covered the lake basins, was broken up by the rise of the land, and Lakes Superior, Huron, and Michigan were formed, their water emptying to the north-eastward and not into the Erie basin. Afterward the land rose higher to the north-eastward, filled the rivers of the basins upward, and turned the upper lakes into Lake Erie. At the same time the rocky barriers caused Lake Erie to drown the western hundred miles of its basin, and the waters are now rising and will in a few centuries cover Toledo and Detroit. The evidence is recorded in the shore lines, which have been surveyed by Professor Gilbert, the author, and others. They have risen in some cases from four to seven feet per mile going northeastward in a period of about fifty years. Prof. G. K. Gilbert in another paper presented a comparison of surveys made on the lake shores twenty or more years ago and within the past year. It is found that changes have taken place, all of which show a rising of the land at the north or northeast as compared with the land at the south or southwest. The whole lake region appears to be undergoing a tilting toward the south southwest at such a rate that of two points a hundred miles apart, the northern rises five inches in a century as compared with the southern. The mean level of the lake rises at Chicago about an inch in ten years, or ten inches in a century.

It is estimated that in about three thousand years all the overflow from the upper lakes will go to the Illinois. The Detroit and St. Clair Rivers will carry water from Lake Erie to Lake Huron instead of from Huron to Erie, and the Niagara River will run dry.

Canada's Oldest Geology.—The presidential address of Dr. D. M. Dawson before the Geological Section of the British Association comprised a comprehensive but highly technical account of the Pre-Cambrian Rocks of Canada. At the close of his review the author said that the general tendency of our advance in knowledge appears to be in the direction of extending the range of the Palæozoic downward, whether under the old name Cambrian or under some other name applied to a new system defined, or likely to be defined, by a characteristic fauna. The somewhat arbitrary and artificial definition of the Olenellus zone as the base of the Cambrian seems to be not of world-wide application, and not even generally appropriate to North America; while as a base for the Palæozoic it is of still more doubtful value. In the Cambrian period as well as in much later geological times the American continent does not admit of treatment as a single province, but is to be regarded rather as a continental barrier between two great oceanic depressions, each more or less completely different and self-contained in conditions and history—that of the Atlantic and that of the Pacific. On the Atlantic side the Olenellus zone is a fairly well-marked base for the Cambrian; on that of the Pacific it is found naturally to succeed a great consecutive and conformable series of sediments, of which the more ancient fauna is now only beginning to be known.

The Thumb and Toes in Men and Apes.—The presidential address of Sir William Turner before the Anthropological Section of the British Association was devoted to some of the characteristics of human structure distinguishing it from that of the apes. Its language is largely technical. The description of the differences in the disposition of the thumb and of the toes presents many points of interest. Both in man and the ape the thumb is not tied to the index digit by an intermediate ligament, which, under the

name of "transverse metacarpal," binds all the fingers together and restricts their separation from each other in the transverse plane of the hand. The great toe of the ape is similarly not tied to the second toe as the other toes are tied to one another and restrained in their movements. The hallux of the ape is therefore set free, and can, like the thumb, be thrown into opposition and be used as a prehensile digit. In the human foot the hallux is tied to the second toe by a continuation of the same transverse metatarsal ligament that ties the smaller toes together. Hence it is impossible to oppose the great toe to the surface of the sole in the way in which the thumb can be used, and the movements of the digits in the transverse plane of the foot are also greatly

restricted. In the hand of both man and the ape the joint between the metacarpal bone of the thumb and the bone of the wrist is concavo-convex, or saddle-shaped, and permits of a considerable range of movements in certain directions, and notably of the movement of opposition. In the foot of man the joint is not thus shaped, and the range of movement is slight. One of the chief factors in the production of the movement of opposition is a special muscle, the *opponens pollicis*, which is so adjusted as to draw the entire digit over the surface of the palm. In the foot of the anthropoid apes there is not complete correspondence among the different species in the similar disposition for moving the great toe, and in some it is altogether absent, as it is in the foot of man.

MINOR PARAGRAPHS.

THE excitement over the discoveries of gold in the Klondike has caused attention to be directed again to the search for the precious metal. Long neglected deposits are re-examined, the gravels of farms are inspected, and bits of sparkling yellow dirt are collected, to have it determined whether there may not be real gold in them. The officers of the mint in Philadelphia are kept busy testing the specimens sent to them. Hardly a day passes, we are told, that the assayers are not called upon for this purpose, and samples of supposed gold and silver quartz and of sand come into the mint by mail and by express. These specimens include every variety of shining rock and dust—pyrites, mica, talc, common sand, and rock sprinkled with crystals; and along with them often come letters which suggest how bitter will be the disappointment of the senders when they learn that the precious stuff from which they anticipate so much is only "fool's gold." They might learn the real nature of their treasure nearer home, but no jeweler's or metal worker's reply will do for them. Nothing but what they consider the highest expert authority will satisfy them.

THE investigations by Prof. Wesley Mills of the psychic development of the rabbit and the cavy or guinea-pig are interpreted by him as illustrating sharp contrasts at birth and

for some time after in animals that in mature life have much physically and psychically in common. The cavy soon after birth is able to care for itself and can maintain an independent existence. The rabbit at birth is blind, deaf, incapable of any considerable locomotive power, and is, generally speaking, in a perfectly helpless condition; but it attains comparative maturity in a month. So simple is the psychic life of both animals that there is little to note in them by way of advance after they are a few weeks old. After the first month of existence comparison with the dog, cat, and allied creatures ceases to be suggestive. The rodents are quite left behind. They seem capable of little education from man or Nature.

IN describing, in the American Association, the Features of Recent Geology around Detroit, Prof. Frank B. Taylor ascribed the extreme flatness of the country mainly to the fact that it was for a long time the bottom of a lake. As the ice sheet retreated northward in the Detroit Valley and northeastward on Lake Erie, it blocked the escape of the water, and a great lake was formed in front of the ice, covering all the Detroit region and all the lowlands around the western end of Lake Erie. A terminal moraine crosses the Detroit River in the vicinity of Detroit and Trenton, but it was laid down in deep water and is not a prominent feature. For a considerable

time the water of this glacial lake was nearly two hundred feet deep over the present site of Detroit. The lake covered all the area of Lake Erie and the low border lands, part of the west end of Lake Ontario, and the southern half of Lake Huron. Its outlet was westward from Saginaw Bay across Michigan through the valley of the Grand River to Lake Chicago (filling the southern part of Lake Michigan), and thence by the Chicago outlet to the Mississippi River. The subsequent history of the lake, as disclosed by the geology, is sketched in the paper.

In a paper read to the American Association upon the scale insects which secrete wax, Dr. L. O. Howard showed that although industries of considerable importance have been derived from the secretions of such insects in Oriental regions, nothing of the kind has so far been done in America. Yet several species exist in the Southwestern States which might possibly be of commercial value. Thus a bark louse is found upon three species of oak in southern California, in practically unlimited supply. A partial chemical investigation has shown that while a very excellent wax may be dissolved by means of chloroform from the insect mass, an insoluble residue remains which has a general resemblance in physical properties to India rubber.

Of the difficulties attending the use of expert testimony in court, Chairman Galbraith, of the Section of Chemistry in the American Association, said that "we are now possessed of so very little of that which may one day be known, that no true scientist hesitates to plead legitimate ignorance, but what really troubles us upon cross-examination is that the court does not speak our language, a language often difficult of direct translation; and the fact that it is but rarely schooled in the principles of our science, and, in consequence, frequently insists upon categorical answers to the most impossible kind of questions." When the expert's testimony has been muddled in this way in the cross-examination, the confusion can not be remedied on the redirect examination, because of the lack of familiarity of the friendly attorney with the subject. This leaves the witness in the position of seemingly disagreeing with his own testimony. As a remedy for this the author favored an appeal to the court,

urging that the oath requires the whole truth and not a misleading portion of it. In order to secure clearness the expert should avoid technicalities as much as possible.

NOTES.

Of the twelve hundred and six species of the animal kingdom which have been represented in the Zoological Gardens of Philadelphia up to the present time, one hundred and four have bred. The propagation of some of our native animals, which are becoming scarce in a wild state, has been conducted with a fair measure of success. This is notably the case with the American bison. Sixteen individuals are now in the gardens, nine of which are females; and all have been bred there except two, which were obtained in exchange for those of the garden's breeding, in order to infuse a new strain into the herd.

THE chapter of Dr. White's Warfare of Science with Theology, From Demoniack Possession to Insanity, is the subject of a friendly and appreciative review by Dr. Warren L. Babcock in the American Journal of Insanity.

A CANADIAN dog story in the London Spectator tells of a little cocker-spaniel dog which was accidentally left by its mistress at a house she visited about a mile from her home. He could not be made to go away till he was taken to the telephone and the trumpet was applied to his ear. Then his mistress called from her house, "Come home at once, Paddy." "Immediately he wriggled out of the boy's arms, rushed at the door, barking to get out, and shortly afterward arrived panting at the rectory."

It is announced by V. H. Velej and L. J. Velej, in Nature of July 1st, that they have found in shipments of rum from Demerara a micro-organism belonging to the group *Coccaceae*, which they regard as a new species. The organism was found as chains of small cocci in the sediment from specimens of barreled rum which had been returned as 42 per cent over proof, equivalent to 74.6 per cent alcohol by weight.

It is generally said that the American Indians at the time of discovery did not use anywhere on the continent a stringed instrument. Dr. D. G. Brinton has, however, found four examples which seem to controvert this, and has described them in a brief paper in The American Antiquarian. One is the *quijongo* of Central America, a monochord with a gourd or jar as resonator. The "Apache fiddle," specimens of which are in the Museum of the University of Pennsylvania, is an instrument of one cord, with a hollow reed as resonator. A third instrument is mentioned by James Adair, in his

History of the American Indians, as having eight strings. The fourth is shown in the Metropolitan Museum, as from Brazil. It has four strings, with a reed and jar. These instruments may be borrowed, but the possibility of their being native and original is sufficient to justify investigation.

THE most important action taken by the council and committees of the British Association during the past year was in the direction of impressing upon the Imperial Government the necessity of establishing a national laboratory of physical research and a bureau of ethnology for Greater Britain. It was felt that the nation does not contribute to physical research to the extent that the benefits derived from the inventions of students of physics warrant, and negotiations are in progress in regard to the matter. The proposed establishment of a bureau of ethnology is expected to be of use to officers performing administrative work, and to missionaries seeking preliminary knowledge of the characteristics of the peoples among whom they are to labor.

THE considerable proportion of young men attending the Toronto meeting of the British Association was remarked in the Globe of that city.

It is regarded as probable by Dr. D. G. Brinton that some valuable writings of earlier students of Mayan antiquities may still exist in the old libraries of Spain or Italy or in private collections of ancient convents. There have already been some accidental findings, as that of Landa's manuscript by Brasseur de Bourbourg, that of another work by Señor Marimon, and that of the *Codex Pereseanus* by De Rosny in a waste basket. But if one knows what to look for, the probabilities of success will be greater. Dr. Brinton, therefore, in his paper mentions authors and titles of works that we know were written previous to the present century on the rites, customs, religions, and antiquity of Mayas, the present whereabouts of which are unknown. The list proves that the early missionaries did not always neglect the pagan rites and histories, and that if we had their manuscripts complete, our knowledge of Mayan antiquities would be greatly enlarged.

WHILE the pioneer work of exploration has been to a great extent accomplished in Africa, and the lines have been run in all directions, Mr. Scott Keltie speaks of the broad meshes between these lines as still needing to be filled in; and one or two regions yet remain that afford scope for the adventurous pioneer. One region of considerable extent, still practically unknown, is south of Abyssinia, and west and north-west of Lake Rudolf, on to the upper Nile. Another extensive area is in the western Sahara. All over the continent are regions that will repay special investigation. Even in northern Africa, an English traveler, Mr.

Cowper, has found, not far from the Tripoli coast, miles of magnificent ruins, and much to correct on our maps; and but little is known of the interior of Morocco and the Atlas Mountains.

COMMITTEES were appointed at the recent Detroit meeting of the American Association to secure uniform nomenclature in the scientific terms used in commerce; and to consider means for extending the influence of the association into the secondary schools.

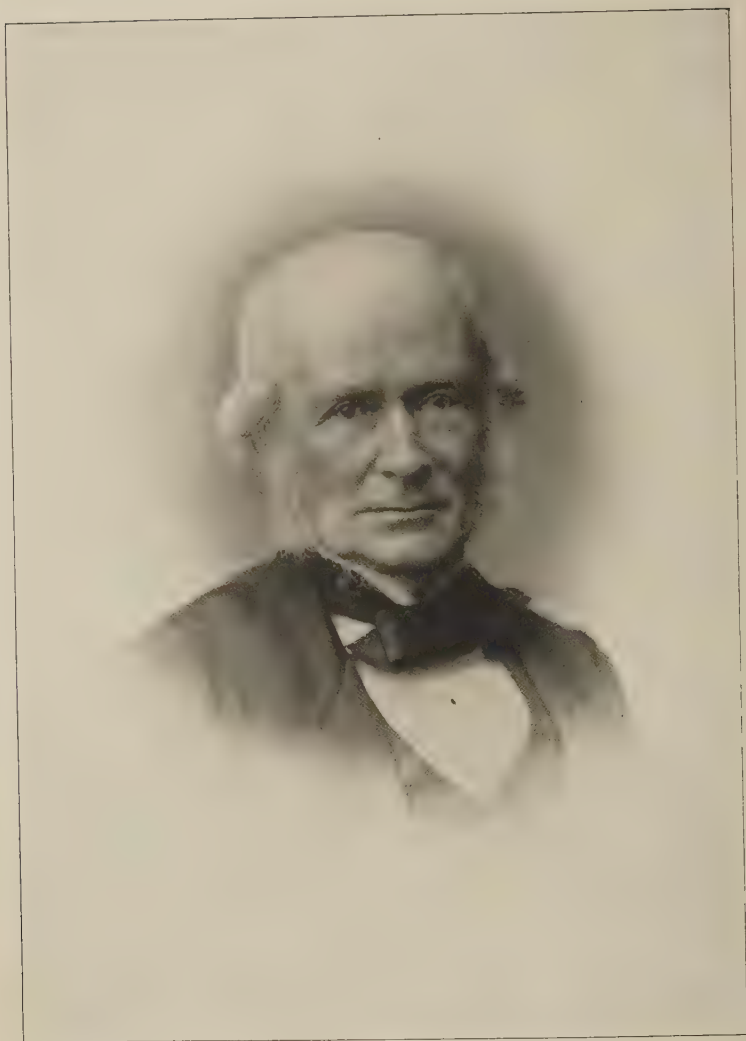
THE vice-president's address of Prof. William Ramsay before the Section of Chemistry in the British Association was devoted to an exposition of his reasons, founded on the atomic relations and behavior of argon and helium, for supposing the existence of another gas not as yet discovered.

THE saguaro cactus of Arizona was described by Mr. Henry G. Hubbard to the Society of Economic Entomologists at Detroit as containing a woodlike fiber, allowing it to resist the most violent winds as solidly as an oak tree. The plants are sometimes sixty feet high, and are of great economic importance, serving in the desert for timber. The Indians use the fiber for roofing, laths, etc., in building their huts.

THE Essex Field Club, England, has been considering methods for protecting the native fauna and flora from the destruction and even extermination with which some species are threatened; and at a recent meeting unanimously adopted a resolution to all lovers of Nature to avoid the danger—(1) by abstaining from wholesale collecting, from collecting for merely individual purposes, from needless rooting up of specimens, from attempting to cultivate wild specimens of refractory species, and from purchasing such wild specimens from dealers; and (2) by endeavoring to persuade others, especially school children, cottage gardeners, and dwellers in large towns, to similar abstention. The need of these precautions is as great in the United States as in England.

A NOTE in Nature from Kumagusu Minakata gives a curious Japanese method of obtaining information regarding the future. "Noma Sanvanoshin narrated that the destiny of a belligerent could well be foretold by means of the 'Tanishi' (common black land snails, gathered for food in muddy rice fields). If two groups consisting each of three of these shellfish be placed in opposite corners of a tray, the three animals representing the future conquerors would advance, while the others which are doomed to defeat would withdraw. This method was approved by repeated experiments during the siege of Osaka (1615)."

THE Hon. Ralph Abercromby, author of some excellent works on meteorology, died at Sydney, New South Wales, June 21st, fifty-four years of age.



SIR JOSEPH PRESTWICH.

APPLETONS' POPULAR SCIENCE MONTHLY.

DECEMBER, 1897.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(*Lowell Institute Lectures, 1896.*)

By WILLIAM Z. RIPLEY, Ph. D.,

ASSISTANT PROFESSOR OF SOCIOLOGY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY; LECTURER IN
ANTHROPO-GEOGRAPHY AT COLUMBIA UNIVERSITY.

XI.—THE BRITISH ISLES.

THE ethnic history of the British Isles turns upon two significant geographical facts, which have rendered their populations decidedly unique among the other states of western Europe.* The first of these is their insular position, midway off the coast between the north and south of the continent. That narrow silver streak between Calais and Dover which has insured the political security and material prosperity of England in later times, has always profoundly affected her racial history. A partial bar against invasion by land, the fatal step once taken, it has immediately become an obstacle in the way of retreat. Invasion thus led inevitably to assimilation. Protected sufficiently against disturbance to assure that homogeneity of type which is attendant upon close contact, the islands at the same time could never suffer from the stagnation which utter isolation implies.

* For invaluable assistance I am deeply indebted to Dr. John Beddoe, F. R. S., late President of the Anthropological Institute of Great Britain, of Bradford-on-Avon, Wilts, not only for the loan of rare material for the illustration of this particular paper, but for kindly criticism and interest throughout our whole series. To President E. W. Braubrook, C. B., of the Anthropological Institute, London, also, I would acknowledge most gratefully my obligation. Recognition should be made of the courtesy of Mr. J. A. Webster, secretary, as well. The complete collection of photographs of the Institute has not

We are still further assured of the truth of these geographical generalizations on comparison of the racial history of England with that of Ireland; for we thereby have opportunity to observe the effects of different degrees of such insularity. In the latter case, it



AN IRISH TYPE. Gray eyes, brown hair. Arran Islands, Galway.

has become a bit too pronounced to be a favorable element in the situation. Disregarding her modern political history—for we are dealing with races and not nations—it is indeed true, as Dr. Beddoe says, that Ireland “has always been a little behindhand.” Ethnic invasions, if they took place at all, came late and with spent energy; most of them, as we shall see, whether of culture or of physical types, failed to reach her shores at all. These laws apply to all forms of life alike. Thus the same geographical isolation which excluded the

only been opened to us, a large part of it has even been subjected to the perils of transportation to America for our benefit. From these two sources all of our portraits are derived.

Authorities comprehensively treating the anthropology of the British Isles are very few. Pre-eminent is Dr. John Beddoe's *Races of Britain*, Bristol and London, 1885; and his *Stature and Bulk of Man in the British Isles*, in *Memoirs of the Anthropological Society of London*, iii, 1870. A full list of a score or more of his scattered papers will be found in our *Bibliography of the Anthropology of Europe*, now in preparation, to appear in *Bulletins of the Boston Public Library*. The monumental work of Davis and Thurnam, *Crania Britannica*, two volumes, London, 1865, covers the whole subject of past and present populations. An essay, *On Some Fixed Points in British Ethnology*, by the late T. H. Huxley, in the *Contemporary Review* for 1871, is a convenient summary, with no attention to the evidence of craniology, however. Finally, the reports of the Anthropometric Committee of the British Association for Advancement of Science, especially its last one in 1883, should not be omitted. Many other papers of local importance are named in our *Bibliography* above mentioned.

snakes of the mainland from Ireland—we are speaking seriously of an established zoölogical fact and not a myth—was responsible for the absence of the peculiar race of men who brought the culture of bronze and other arts into England in prehistoric times. It also accounts for the relative scarcity of the Teutonic invaders afterward. As we may grade both the flora and fauna of the islands in variety of species from the continent westward, so also may we distinguish them anthropologically. In flora, Ireland has but two thirds the species indigenous to England and Scotland; for the same reason her human population contains much less variety of human type.* Among the Irish peasantry there are no such contrasts as those we shall show to exist between the highland and the lowland Scotch, or between the Englishman in Cornwall and in Yorkshire.

A second geographical peculiarity of the British Isles has not been devoid of importance to us. The eastern island contains both extremes of fertility and accessibility. Ireland is far more uniform. A point for us to note is that the backbone of each island lies along the west coast. Both England and Scotland certainly present their best sides to the continent; all the way from Caithness to Kent either the most fertile lands, or the mouths of rivers leading to them, lie on the east. The same thing is mainly true of Ireland. The result, of course, is the accentuation of the contrasts between the populations of the east and west sides in either case. The best lands are at the same time nearest the mainland. All incentive to further invasion ceases at once. The significance of this will appear in due time. We may realize its importance in advance, however, by supposing the situation reversed, with the goal of all invasions on the farther side of each island. Is there a doubt that Wales, the western Scottish highlands, and farther Ireland would have been far more thoroughly infused with foreign blood than they are in reality to-day? It makes a great difference whether a district is on the hither or the hinter side of Canaan.

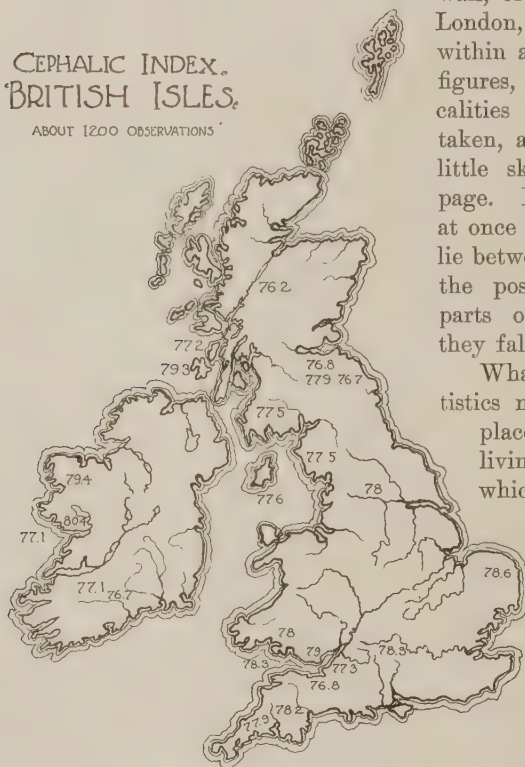
The most remarkable trait of the population of the British Isles is its head form; and especially the uniformity in this respect which is everywhere manifested. The prevailing type is that of the long and narrow head, accompanied by an oval rather than the round face. This uniformity makes the task of illustrating types by means of portraits peculiarly difficult; for the shape of the head is the main characteristic directly shown by them. It should also always be borne in mind that when we speak of broad or oval faces we refer to the proportions of the bony framework alone. We must look below the flesh, behind beard or whiskers, or else endless confusion will result. Full cheeks need not imply a broad face as we mean it;

* Sir A. Geikie, in *Macmillan's Magazine*, March, 1882, pp. 367 *seq.*

the width at the malar bones is the crucial test. Measured by the cephalic index—that is, the extreme breadth of the cranium expressed in percentage of its length from front to back—the uniformity in type is so perfect that it can not be represented by shaded maps as we have heretofore been accustomed to do. Wherever heads have been measured, whether in the Arran Islands off the west coast of Ireland, the Hebrides and Scottish Highlands, Wales and Cornwall, or the counties about

CEPHALIC INDEX. BRITISH ISLES.

ABOUT 1200 OBSERVATIONS.



London, the results all agree within a few units. These figures, noted upon the localities where they were taken, are shown upon our little sketch map on this page. It will be observed at once that the indexes all lie between 77 and 79, with the possible exception of parts of Scotland, where they fall to 76.

What do these dry statistics mean? In the first place, they indicate a living population in which the round-headed Alpine race of central Europe is totally lacking; an ethnic element which, as we have already shown in our preceding articles, constitutes a full half of the present popu-

lation of every state of middle western Europe—that is to say, of France, Belgium, Italy, and Germany. We have already proved that this Alpine race is distinctively a denizen of mountainous regions; we christened it Alpine for that reason. It clings to the upland areas of isolation with a persistency which even the upheavals of the nineteenth century can not shake. Almost everywhere it appears to have yielded the seacoasts to its aggressive rivals, the Teutonic long-headed race in the north and the dolichocephalic Mediterranean one on the south. This curious absence of the broad-headed

Alpine race in the British Isles therefore is merely another illustration of its essentially continental character.

Before we proceed to consider the other physical traits of the living population, we must draw in a background by a hasty summary of the facts which the science of archæology has to offer concerning the prehistoric human types in the islands. In the first place, it is certain that the earliest inhabitants were decidedly long-headed, even more so than any Europeans of to-day; far more so than the present British. The evidence concerning this most primitive stratum is carefully presented by Boyd Dawkins in his *Early Man in Britain*. These men, whose remains have been unearthed in caves and whose implements have been discovered in the river drift of the late glacial epoch, were decidedly dolichocephalic. Both in the stage of culture attained and in head form they were so like the Eskimo of North America that Nilsson more than a half century ago suggested a common derivation for both. Boyd Dawkins lends his support to the same hypothesis, assuming that as the ice sheet withdrew to the north, these primitive folk followed it, just as we know to a certainty that the mammoth, mastodon, and other species of animals have done. A former connection of Europe with Greenland would have made this migration an easy matter. Whether this interesting supposition be true or not, we know that the earliest type of man in Britain was as long-headed as either the African negro or the Eskimo—that is to say, presenting a more extreme type in this respect than any living European people to-day.

The second population to be distinguished in these islands was characterized by a considerably higher culture; but it was quite similar, although somewhat less extreme in physical type than the preceding one, so far as we can judge by the head form. This epoch, from the peculiarities of its mode of interment, is known as the long-barrow period.* The human remains are found, often in considerable numbers, generally in more or less rudely constructed stone chambers, covered with earth. These mounds, egg-shaped in plan, often several hundred feet long, are quite uniform in type. The bodies are found at the broader and higher end of the tumulus, which is more often toward the east, possibly a matter of religion, the entrance being upon this same end. These people were still in the pure stone age of culture; neither pottery nor metals seem to

* The best authorities upon this and the succeeding type are Canon Greenwell's *British Barrows*, with its anthropological notes by Dr. Rolleston, at pages 627-718; the *Crania Britannica* above mentioned, but more especially the essays by Dr. Thurnam in *Memoirs of the Anthropological Society of London*, vol. i, pp. 120-168, 458-519; and vol. iii, pp. 41-75. Consult also Rolleston i: *Journal of the Anthropological Institute*, London, vol. v, pp. 120-172.

have been known. But a distinct advance is indicated by the skillfully fashioned stone implements. Such long barrows occur most frequently in the southwest of England, in the counties of Wilts and Gloucestershire, especially in the bleak uplands of the Coteswold

Shetland Islands.



SCANDINAVIAN MIXED TYPE.



"OLD BLACK BREED" TYPE.

Hills; but they are also found much farther north as well. The people of this period were, as we have said, like their predecessors, extremely long-headed. The cephalic index in the life was as low as 72, several units below any average in Europe to-day, save per-

haps in parts of Corsica. It is worthy of note also that a remarkable purity of type in this respect was manifested; positively no broad crania with indexes above 80 have ever been found. These long-barrow men were also rather undersized, about five feet five inches—that is to say, an inch shorter than any average prevailing to-day. The full significance of this important point will appear shortly. The evidence seems to bear out the conclusion that thus far we have to do with but one race type, which had, however, slowly acquired a low stage of culture by self-education.

This neolithic, or stone age, primitive type is still represented in the present population, according to the testimony of those best fitted to judge. Our portrait herewith of an ancient British type, locally known in the Shetland Isles as “the old black breed,” because of its accentuated brunetteness, is probably a good specimen. The long head and dark complexion are said to-day to be more often associated with short stature than otherwise.

The next event in the prehistoric history of the British Isles—pardon the bull, it conveys our meaning—is of profound significance. Often directly superposed upon the relics of the long-barrow period, and in other ways indicating a succession to it in time, occur the remains of an entirely different racial type. This stratum represents the so-called round-barrow period, from the circumstance that the burial mounds are no longer ovoid or elongated in ground plan, but quite circular or bell-shaped. The culture is greatly superior to that of its predecessor. Pottery, well ornamented, occurs in abundance, and the metals are known. Bronze implements are very common, and even a few traces of iron appear. Now the dead are often buried in urns, showing that incineration must have been practiced. More remarkable than this advance in culture, and more directly concerning our present inquiry, the people were as broad-headed as the modern peasants of middle France. The cephalic index was fully ten points on the average above that of the long-barrow men, averaging about 83 in the life. The former type has not entirely disappeared, but it is in a decided minority. So persistent is the difference that Dr. Thurnam’s well-known axiom, “long-barrow, long skull; round-barrow, round head,” is accepted as an ethnic law. It is impossible to emphasize too strongly the radical change in human type which is hereby implied. The contrast is every whit as marked as that between a modern Alpine peasant and a south Italian or Scandinavian. The new population differed in still another important respect from the underlying one. This is known from scores of detailed measurements of skeletons. The average stature was fully three inches greater, rising five feet eight inches. The round-barrow population therefore attained a bodily

height more respectable as compared with the present living one than its stunted predecessor. Dr. Beddoe has selected the accompanying portrait as representing this almost extinct broad-headed type of the bronze age. It is said to be not uncommon in the remoter



ROUND-BARROW BRONZE-AGE TYPE. Cumberland.

parts of Cumberland. The heavy brow ridges seem to be a noticeable peculiarity of it.

The generally accepted view among anthropologists to-day is that the round-barrow men came over from the mainland, bringing with them a culture derived from the east. We can never know with certainty whether they were Celtic immigrants from Brittany; where, as we have already shown, a similar physical type prevails to-day—such is Thurman's view: or whether they were the vanguard of the invaders from Denmark, where a round-headed type was for a time well represented, an opinion to which Dr. Rolleston inclines. This latter hypothesis is strengthened by study of the modern populations, both of Norway and the Danish peninsula. For example, turn for a moment to our map on page 158, showing the head form in Scandinavia to-day. Notice how the tints darken, that is to say, the heads broaden, in the southwest corner of Norway. The same thing is true just across the Skager Rack in Denmark proper, where the round-headed type is still more frequent than immediately to the south in Schleswig-Holstein and Hanover. This neighborhood was once a distinct subcenter of distribution of this type. It might readily have come over to England from here, as the Jutes, Angles, and Saxons did a few centuries later. Differing in these details as to their precise geographical origin, all authorities

are nevertheless agreed that the round-barrow men came from the continent somewhere. Any other derivation would have been an impossibility. We also know that this Alpine immigrant type overran all England and part of Scotland. It never reached Ireland because of its remoteness; with the result that greater homogeneity of type prevails therein, while at the same time the island was deprived of a powerful stimulus to advance in culture. This is the first indication of the geographical handicap under which Erin has always labored. Finally, we have to note that this broad-headed invasion of the round-barrow period is the only case where such an ethnic element ever crossed the English Channel in numbers sufficient to affect the physical type of the aborigines. Even here its influence was but transitory; the energy of the invasion speedily dissipated; for at the opening of the historic period, judged by the sepulchral remains, the earlier types had considerably absorbed the newcomers.

The disappearance of the round-barrow men is the last event of the prehistoric period which we are able to distinguish. Coming, therefore, to the time of recorded history, we find that every influence was directed toward the complete submergence of this extraneous broad-headed type; for a great immigration from the northern mainland set in, which, after six hundred years of almost uninterrupted flow, completely changed the complexion—we speak literally as well as figuratively—of these islands. The Teutonic invasions from Germany, Denmark, and Scandinavia are the final episodes in our chronicle. They bring us down to the present time. They offer us a brilliant example of a great ethnic conquest as well as of a military or political occupation. The Romans came in considerable numbers; they walled cities and built roads; they introduced new arts and customs; but when they abandoned the islands they left them racially as they were before; for they appear to have formed a ruling caste, holding itself aloof in the main from intermarriage with the natives.

Not even a heritage of Latin place names remains to any considerable degree. Kent and Essex were of all the counties perhaps the most thoroughly Romanized; and yet the names of towns, rivers,



ANGLO-SAXON BLONDISH TYPE.
Surrey.

and hills were scarcely affected. The people manifest no physical traits which we are justified in ascribing to them. The Teutonic invasions, however, were of a different character. The invaders, coming perhaps in hopes of booty, yet finding a country more agreeable for residence than their barren northern land, cast in their lot with the natives in many districts forming the great majority of the population. We find their descendants all over Britain to-day.

These Teutonic invaders were all alike in physical type, roughly speaking. We can scarcely distinguish a Swede from a Dane to-day, or either from a native of Schleswig-Holstein, or Friesland, the home of the Jutes, Angles, and Saxons. They are all described to us by chroniclers, and our modern research corroborates the testimony, as tall, tawny-haired, fiercely blue-eyed barbarians. Evidence there is indeed that the Alpine broad-headed race once effected a lodgment in southwest Norway, as we have already said. Our map of that country on a subsequent page shows a persistence greatly attenuated, of that trait all along the coast. Archæology shows it to have invaded Jutland also in early times; but it seems to be of secondary importance there to-day. The Danes are somewhat broader-headed than the Hanoverians perhaps, but, practically speaking, they are all tall and blond Teutons.

Since we can not follow these invaders over Britain by means of their head form, they being all alike and entirely similar to the already prevailing type in the British Isles previous to their advent, we must have recourse to a contributory kind of evidence. We have at times made use of the testimony of place names heretofore; but it is nowhere else in Europe so clear or convincing as in this particular case. We may trace with some surety each current of the great Teutonic inundation by means of them. Then, having done this and completed our historical treatment of the subject, we may once more take up the main thread of our argument by returning to the study of the living population. We shall thus have the key to the situation well in hand. The distribution of color of hair and eyes and of stature will have a real significance.

Our map on next page, adapted from Canon Taylor's exceedingly valuable little book entitled *Names and Places*, will serve as the mainstay of our summary. In choosing our shading for it, we had one object in mind, which we can not forbear from stating at the outset. The three shades denoting the Teutonic place names are quite similar in intensity and sharply marked off from the Celtic areas, which we have made black. This is as it should be, for the whole matter involves a contrast of the three with the one which we know to be far more primitive and deep-seated. The witness of spoken language, to which we shall come shortly, would suffice to



confirm this, even had we no history to which to turn. Our map shows at a glance an island where once all the names of natural features of the landscape and of towns as well were Celtic. This primitive layer of names has been rolled back by pressure from the direction of the mainland. It is a unit opposed to the combined aggression of the Germanic tongues.

The Jutes, Angles, and Saxons set the Teutonic ball a-rolling. They came from the northern coast of Germany, from the marshes and low-lying country of Friesland. These barbarians seem to have followed close upon the heels of the retiring Romans, making their appearance about the year 400 of our era. The whole island lay open to them, and they made haste to overrun the best of it. They avoided the fens and forests, to which the natives withdrew. Within two hundred years their influence had extended even to the uttermost parts of Ireland, over the whole of which, as our map shows, Saxon village names sporadically occur. The main center of their occupation was in the southeast and middle of England, where, from their first landings in Kent and Essex, they transformed the entire country. Scotland also, south of Edinburgh, was infused with Saxon blood if we may judge from our map. This district, from the river Tees to the Forth, is in fact, as Taylor says, as purely English as any part of the island. The Lothians were reputed English soil until the eleventh century. Scotland begins racially not at the political boundary of the river Tweed and Solway Firth, but at the base of the Grampian Hills. The correspondence of a map of physical geography and of Celtic place names in Scotland shows a relation of cause and effect.

This first inoculation with Teutonic blood was an unwilling one. We have every evidence that the struggle was bitter to the end. The tale of Saint Guthlac, a devout Briton, shows it. Disturbed in his meditations one night by a great uproar outside his hermit hut, he engaged himself in prayer for preservation until the morning. The chronicler tells us that he was much relieved at day-break by the discovery that the midnight marauders were *only devils* and not Saxons. So strong was the race antipathy that the laws forbade a Briton from drinking from a cup touched by a Saxon till it had been scoured with sand or ashes. Two hundred years of such a struggle could not but modify the purity of the native stock, as we shall be able to prove.

About the year 850 came the second installment of the Teutonic invasion at the hands of the Danes. They put an end to the inroads of their Saxon predecessors by attacking them in the rear. Two contrasted kinds of expeditions seem to have been dispatched against the island. Those which besieged London and skirted the southern

coasts were mainly piratical; few names indicating any permanent settlement occur. These Danes were in search of booty alone. Farther north, especially in Lincolnshire and its vicinity, the character of the names betokens intentional colonization, and a very intensive one at that. Thus, nearly a quarter of all the village names in Lincolnshire terminate in "by," as Whitby, Derby, and the like. The Saxon equivalent for this Danish word for village is "ham" or "ton," as Buckingham and Huntington. The line of demarcation of Danish settlement on the south is very sharp. The fens deterred them from extending in this direction, for the marshes were long a stronghold of the British, as we have seen. From the Wash north over Yorkshire to the Tweed they occupied and settled the country effectively. Three hundred years were necessary to accomplish this result.

The Norwegians, coming next, mainly confined their attention to the northern and western coasts of Scotland, shunning their vigorous competitors to the south. They attacked the island from the back side. The fringe of Norse place names upon our map is very striking. These Teutons rarely penetrated far inland in Scotland, especially along this west coast, for here the country is rugged; the only means of communication is by sea; so that the isolated colonies of "baysmen" were speedily absorbed. On the islands—the Shetlands, Orkneys, and Hebrides—the case was different. Here the aborigines were often entirely replaced by a purely Scandinavian population. Such a family with strongly accentuated Norwegian peculiarities is depicted herewith. Its contrast with the aboriginal dark population, the "old black breed," shown on a preceding page, needs no comment. The effect of a lesser Teutonic strain in the old stock is clearly manifested in the second type which accompanies our previous portrait. One reason for the Teutonization of these islands is that



SCANDINAVIAN TYPES.
Lewis, Hebrides Islands.

they were really wintering stations and bases of supplies for the expeditions along the coasts of Scotland, Ireland, and Wales during the summer season. The only other district where Norse settle-

ments occur in frequency is, as our map shows, in Lancashire and the lake district. This may also have been a center whence expeditions all about the western coasts took place, planting little stations where opportunity offered.

The Normans, last of the Germanic series, came to the islands after they had become so infiltrated with Teutonic settlements that but few traces of them separately can be detected. They did not come as they entered Normandy, as colonizers; but as political conquerors, a few thousand perhaps, forming a ruling class, just as the Franks invaded south Germany or Burgundy. Their influ-

CEPHALIC INDEX NORWAY.

AFTER ARDO. '07
ABOUT 6000 OBSERVATIONS.

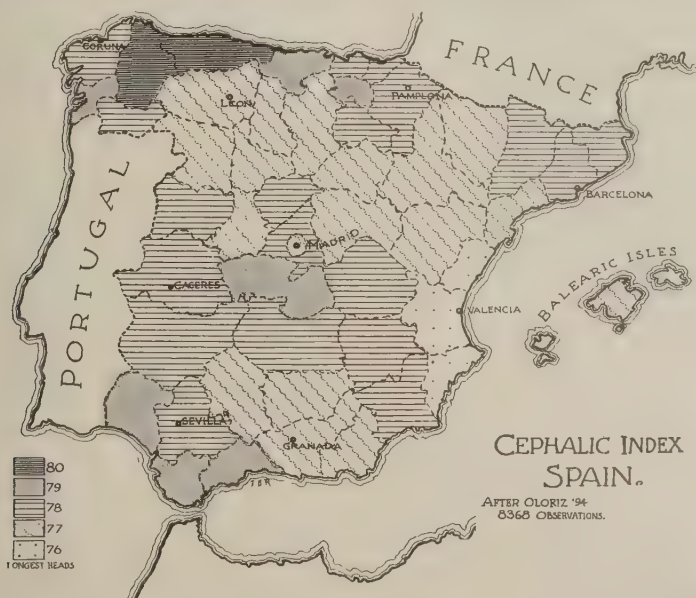


fluence is most strongly shown in York and parts of Lancashire and Durham. Much of the land here they laid entirely waste; what they did with the native owners we can only surmise. At a later time a gradual influx of Norman blood made itself felt in the south and east of England, so that Dr. Beddoe concludes that by the time of Edward I perhaps a fifth of the population was of Norman descent more or less indirectly.

The Teutonic immigration had now run its course. The islands were saturated. Let us see what the anthropological effect has been by returning once more to the consideration of physical characteristics alone.

We are now prepared to show why it is that in head form the

population of the British Isles to-day is so homogeneous. The average cephalic index of 78 occurs nowhere else so uniformly distributed in Europe, nor does it anywhere else descend to so low a level, save at the two extremes of the continent in Scandinavia and Spain. For purposes of comparison we have reproduced two maps of these regions herewith. Of Norway we know more in detail than of Sweden, thanks to the indefatigable Dr. Arbo; but the one country is typical of the other. These maps make it clear beyond a shadow of doubt that in these two outlying members of Europe we have to do with relatively homogeneous populations in this respect. Other facts in our possession prove that this uniformity of head form is the concomitant and index of two relatively pure, albeit widely different, ethnic types—Mediterranean in Spain, Teutonic in Norway. Purity of descent in each case—that is to say, freedom from ethnic intermixture—is the direct and inevitable outcome of peninsular isolation. It is now proper to ask—and this is the crucial question, to whose elucidation all of our argument thus far has been contributory—whether we may make the same assumption of racial purity concerning the British popu-



lations. We have a case of insularity even more pronounced than in Spain or Norway; we have cephalic uniformity. The interest of our problem intensifies at this juncture. If relatively pure, have we to do with the type of the Teuton, or of the Iberian race? We

are generally known as Teutonic by descent. Or is there some complex product here made up of both ethnic elements, in which



case the apparent homogeneity revealed by the head form is entirely specious and misleading? As our mainstay in such matters, cephalic index, fails us utterly, since both north and south are precisely alike in this respect, we must rely upon the other, albeit less stable, physical traits. To these we turn next in order.

A glance at the accompanying map of relative brunetteness suffices to show a curious increase of pigmentation from northeast

to southwest, measured by the prevailing color of the hair.* The map is almost the exact counterpart of our preceding one of place names. From our previous articles we might have been led to expect such an increase from north to south; for that is the rule in every continental country we have studied. The phenomenon we found to be largely a matter of race; but that physical environment, notably climate, played an important part. Moreover, we proved that in elevated districts some factor conduced to increase the blondness, so that mountains more often contained a fairer population than the plains roundabout. Here is a surprising contradiction of that law, if law it be; for the Grampian Hills in Scotland, wild and mountainous Wales, and the hills of Connemara and Kerry in western Ireland, contain the heaviest contingent of brunette traits in the islands. The gradation from east to west is in itself a flat denial of any cli-



BRUNETTE TYPE. Welshman. Montgomeryshire.

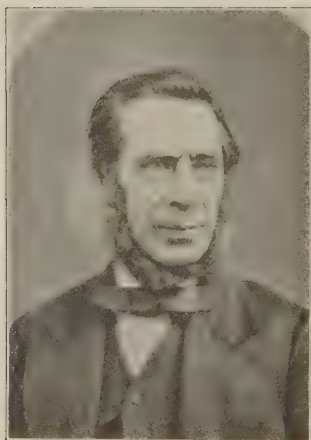
matic influence, for the only change in that direction is in the relative humidity induced by the Gulf Stream.

The darkest part of the populations of these islands constitutes the northern outpost of that degree of pigmentation in Europe. Western Ireland, Cornwall, and Argyleshire in Scotland are about as dark, roughly speaking, as a strip across Europe a little farther

* This map is constructed upon a system adopted by Dr. Beddoe as an index of pigmentation. It differs from others mainly in assigning especial importance to black hair as a measure of brunetteness, on the assumption that a head of black hair betrays twice the tendency to melanosity of a dark brown one. Without accepting this argument as valid, the map in question seems to accord best with others constructed by the measurement of pure light and dark types on the German system. Dr. Beddoe regards this one as best illustrating the facts in the case.

south, say from Normandy to Vienna. Even in these most brunette areas pure dark types are not very frequent. No such extremes occur as Italy and southern France present. The prevailing combination is of dark hair and grayish or hazel eyes. Such is particularly the case among the western Irish and southern Welsh.* So striking is the brunetteness in the latter case that we find an early writer in this century, the Rev. T. Price, ascribing the prevalence of black hair in Glamorganshire to the common use of coal as fuel. Without accepting this hypothesis, we may be certain of the strongly accentuated brunetteness of the peasantry hereabouts. The accompanying Welsh type, strongly brunette, with black hair, is a good example. The opposite extreme of blondness corresponds, as nearly as we can judge, to the continental populations in the latitude of Cologne. Light hair and brown or blue eyes become common. This is not as fair as the pure Teutonic race in Scandinavia. We shall probably not be far wrong in the statement that the extremes

Scottish Highlands.



TALL, LIGHTER TYPE. Moray.



"A GOOD SPECIMEN OF THE LITTLE DARK RACE." Argyleshire.

in the British Isles are about as far separated from one another as Berlin is from Vienna. In the darkest regions pure brunette types are more frequent than the blond by about fifteen per cent. In the eastern and northern counties, on the other hand, the blondes are in a majority by an excess of about five per cent. Everywhere, however,

* The recent work of Haddon and Browne, published in the Proceedings of the Royal Irish Academy, Dublin, since 1893, on the western Irish, is our best recent authority on this people.

all possible crossings of characteristics appear, proving that the population is well on the road toward homogeneity. It is especially worthy of note that blondness in some districts often takes the peculiar form of freckled skin and red hair. We in America are familiar with the two types of Irish—one thus constituted, while the other is more often compounded of the black or dark brown hair and steel-blue eyes. It seems, from everyday observation, as if this latter variety were far more common among the women in our immigrants from Ireland. A similar contrast is remarkable in Scotland. Here, in fact, in some districts red-headedness is more frequent than anywhere else in the world, rising sometimes as high as eleven per cent. Topinard has undertaken to prove in France that this phenomenon is merely a variation of blondness.* At all events, his maps show that red hair is most frequent in the lightest departments. In Scotland the same rule applies, so that the contrasts between east and west still hold good. The Camerons and Frasers are as dark as the Campbells are inclined to red-headedness.



CORNWALL TYPE. Black hair and eyes.

Seeking for the clew to this curious distribution of brunetteness in the British Isles, we may make use for a moment of the testimony of language. The Celtic speech is represented to-day by Gaelic or Goidelic, which is in common use in parts of Scotland and Ireland; and secondly by Kymric or Brythonic, which is spoken in Wales. It was also spoken in Cornwall until near the close of the last century, when it passed into tradition. On our map of brunetteness we have roughly indicated the present boundaries of these two branches of the Celtic spoken language. It will be noted at once that the darkest populations form the nucleus of each of the Celtic language areas which now remain, especially when we recall what we have just remarked about Cornwall. Leaving aside for the moment the question whether this in any sense implies that the original Celts were a dark people, let us be assured that the local persistence of the Celtic speech is nothing more nor less than a phenomenon of isolation to-day. The aggressive English language

* *L'Anthropologie*, iv, 1893, pp. 579 *seq.*

has been crowding its predecessor to the wall in every direction.* This has been proved beyond all possible doubt. In the nooks and corners, the swamps and hills, where the railroad and the newspaper are less important factors in everyday life, there we find a more primitive stratum of language. Is it not justifiable for us, from the observed parallel between speech and brunetteness, to assume also that of the two the darkest type in the British Isles is the older? Such is our argument. One detail of our map confirms us in this opinion. Notice the strongly marked island of brunetteness just north of London. Two counties, Hertfordshire and Buckinghamshire, are as dark as Wales, and others north of them are nearly as unique. All investigation goes to show that this brunette outcrop is a reality. It is entirely severed from the main center of dark eyes and hair in the west by an intermediate zone as light as Sussex, Essex or Hampshire (Hants). The explanation is simple. We have already shown that the south Saxons entered England by the back door. They spread inland from the southern coast, prevented from following up the Thames by the presence of London. On the other side the same invaders pushed south from the Wash and the Humber. These two currents joined along the light intrusive zone. Our dark spot is the eddy of native traits, persistent because less overrun by the blond Teutons. The fens on the north, London on the south with dense forests in early times, left this population relatively at peace. This, history teaches us. Natural science corroborates it strikingly. In a later article, considering purely social phenomena, we shall show that peculiarities in suicide, land tenure, habits of the people, and other details of these counties are likewise the concomitants of this same relative isolation. The fact is all the more striking because the district lies so close to the largest city of Europe.

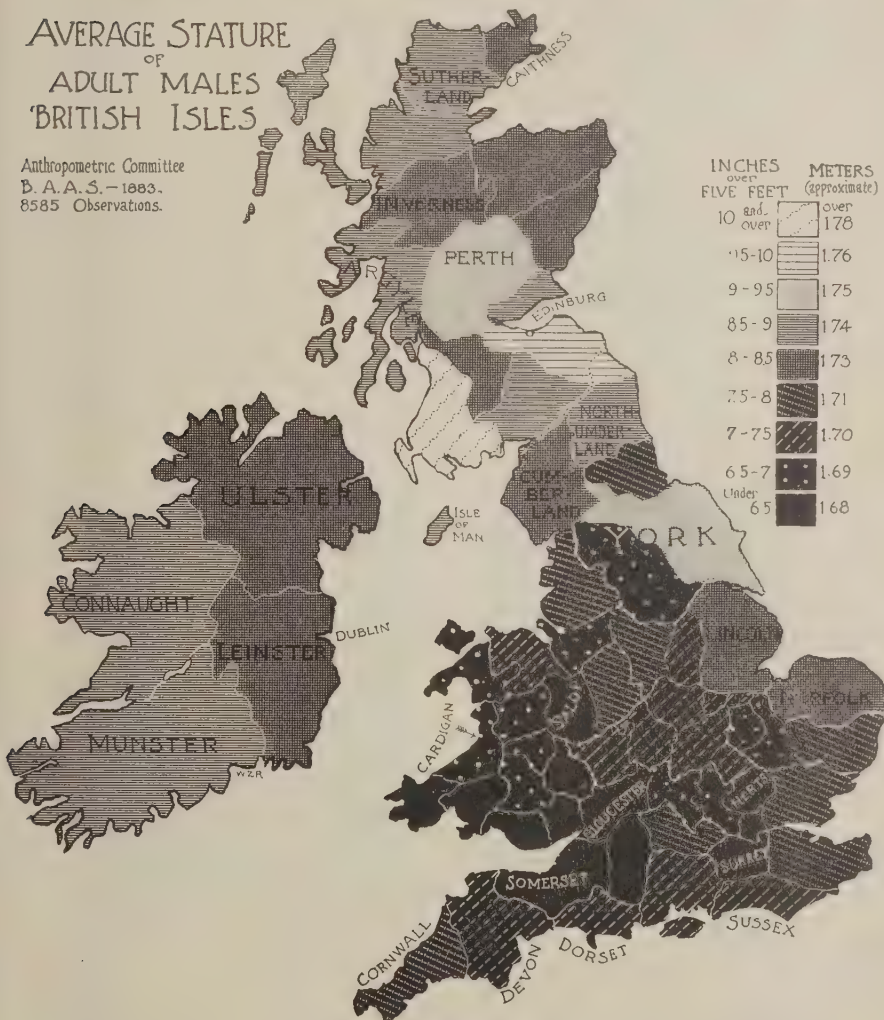
This variation of brunetteness in Britain is not a modern phenomenon. The contrast between northeast and southwest, while of course largely a result of the Teutonic invasions of historic times, should not be entirely ascribed to them. They have in all likelihood merely accentuated a condition already existing. This we assume from the testimony of Latin writers. In fact, 'Tacitus' statements, the mainstay of the hypothesis of an Iberian substratum of population in Britain, prove that long before the advent of the Saxons several distinct physical types coexisted in Roman Britain. One of these, he tells us in the eleventh chapter of his *Agricola*, was the Caledonian, "red-haired and tall"; the other, that of the Silures in southern Wales, with "dark complexion and curly hair." He also

* Ravenstein has mapped it in detail for different decades in the *Journal of the Royal Statistical Society*, London, vol. xlii, 1879, pp. 579-643.

notes the similarity in appearance between the southern Britons and the Gauls, and suggests a Germanic origin for the Caledonians, an Iberian one for the Welsh, and a Gallic one for the English. This is positively all that he said upon the subject, never having been

AVERAGE STATURE
OF
ADULT MALES
'BRITISH ISLES.

Anthropometric Committee
B. A. A. S. — 1883.
8585 Observations.



in the country. Then Jornandes, a mediæval Italian commentator, added fuel to the flame by amending Tacitus' words concerning the Silures of Wales, giving them not only "dark complexions," but "*black, curly hair.*" Such were the humble beginnings of the

Iberian hypothesis, notwithstanding which it has passed current for generations as if founded upon the broadest array of facts. What if we should conclude that the assumption is correct in the light of modern research! It is no justification for the positiveness with which the law has been laid down by hosts of secondary writers. By such a tenuous historical thread hangs many another ethnic generalization. May the day come when the science of anthropology assumes its due prominence in the eyes of historians, and renders the final judgment in such disputed cases of physical descent!

Thus far all has been plain sailing. It seems as if the case were clear. An Iberian brunette, long-headed substratum, still persistent in the western outposts of the islands, dating from the neolithic long-barrow period, or even earlier; and a Teutonic blond one, similar in head form in all the eastern districts overrun from the continent, seem to be indicated. Now we have to undertake the addition of a third physical trait—stature—to the others, and the complexity of the problem appears. Our map on page 165 shows that the British Isles contain variations in average of upward of four inches. Scotland, as we have shown elsewhere, contains positively the tallest population in Europe and almost in the entire world. Even the



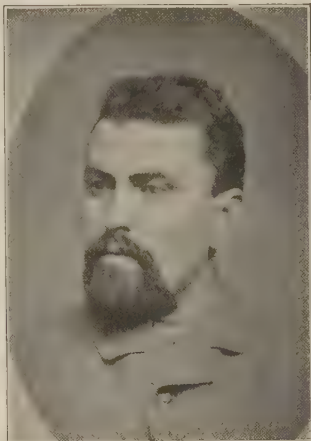
BRUNETTE WELSH TYPE. Cardiganshire.

average of five feet six inches and over in Wales and southwest England is not low; for this is greater than any on the continent south of the Alps. Broadly viewed, the facts in England alone seem to fit our hypothesis. Here we observe the eastern counties relatively tall, with a steady decrease as we pass westward, culminating in southern Wales. The ancient Silures or their modern descendants

are still relatively short, with an average stature but an inch or so greater than the long-barrow men of the stone age. For England, then, the maps of brunetteness and of average stature agree remarkably well. Our portrait herewith represents this common Welsh type. In this case the hair was very deep brown, with dark eyes. The slender build and short stature are characteristic. Even the curious dark spot north of London, which we have already identified as an ancient British outcrop, appears clearly upon our map. It seems to be nearly severed from the western short populations by an intermediate and seemingly intrusive zone of taller men. As a rule, coast populations all over England are taller than inland ones. Even Ireland does not seriously embarrass our hypothesis of a primitive dark and short population. The eastern half, to be sure, is shorter than the western; but a variation of half an inch is not very much, and we know that the Irish are much more homogeneous than the English or Scotch in color of hair and eyes. The western half ought certainly to be shorter to fit our hypothesis exactly, but we might possibly ascribe this to chance, to an inadequate statistical basis, or some other cause.

Consideration of the distribution of stature in Scotland, however, is enough to reduce the consistent anthropologist to despair. The physical traits seem to cross one another at right angles. Inverness and Argyleshire, as brunette as any part of the British Isles, equaling even the Welsh in this respect, are relatively well toward the top in respect of stature. This is all the more remarkable since this mountainous and infertile region might normally be expected to exert a depressing influence. To class these Scotchmen, therefore, in the same Iberian or neolithic substratum with the Welsh and Irish is manifestly impossible. The counties south of them, where stature culminates for all Europe, are also fairly dark. Only two explanations seem possible. Either some ethnic element, of which no pure trace remains, served to increase the stature of the western Highlanders without at the same time conducing to blondness; or else some local influences of natural selection or environment are responsible for it. Men with black hair are indeed shorter in many places, but the averages shown on our map belie any general law in that direction. We have no time to discuss the phenomenon further in this place. As Dr. Beddoe acknowledges, the difficulty is certainly a grave one. At all events, a profound contrast in respect of stature between the two branches of the Celtic-speaking peoples is certain. The only comforting circumstance is that we thus find in language some indication of a very early division of the Gael from the Brython. On the whole, the Gaelic branch, the Irish and Scotch, seem to agree in stature, and to contrast alike with the

Brythonic branch of the Welsh and Cornish. It is permissible to suppose that the absence of contact implied by these ancient linguistic differences might allow of a separate modification of the Scottish wing to the end we have observed. At all events, we have laid bare



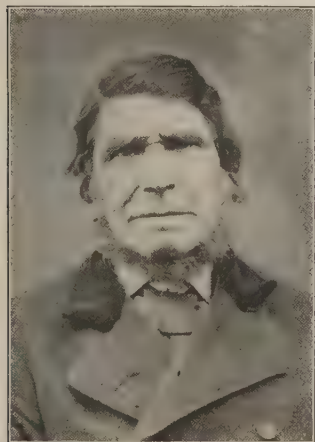
BLONDISH ANGLO-SAXON TYPES. Yorkshire.

the facts, even if we have pricked holes in the Iberian hypothesis thereby.

Enough portraits have now been presented to admit of a few hasty generalizations concerning the facial features peculiar to Britain. To be sure, all sorts of difficulties beset us at once. It is unfair to compare different ages, for example. The youthful countenance is less scarred by time. Nor, again, is it just to draw comparisons from different stations in life. In the same race the exposed farm laborer will differ from the well-fed and groomed country gentleman. Strongly marked racial differences between social classes exist all over the islands. The aristocracy everywhere tends toward the blond and tall type, as we should expect. We may, however, draw a few inferences from the data at our disposal, which seem to be well grounded in fact. The most peculiar characteristic of the Teutonic face, as a whole, is its smooth, almost soft, regularity. The lower jaw of the brunette and more primitive type is apt to be squarish and heavy, with the bony ridges above the eyes strongly pronounced. This latter trait appears in nearly all our portraits—Welsh, Scotch, or Irish. It is notable in the Cornishmen. In all cases this endows the features with a certain ruggedness and strength which is pleasing to the eye. Finally—for we have no space to enlarge upon the subject in this place—the nose in the Teuton is more

apt to be finely molded, thin, and straight. In the early British it is heavier, broad at the nostrils, and inclined to irregularity in profile. Facial peculiarities are, however, so open to modification by artificial selection that they are quite untrustworthy for purposes of racial identification by themselves alone. Only when combined with the more fundamental traits which we have already examined may we place confidence in their testimony.

A by no means negligible factor in the discussion as to the ethnic origin of the most primitive stratum of the populations of the British Isles is temperament. To treat of disposition thus as a racial characteristic is indeed to trench upon dangerous ground. Nevertheless, remembering how potent environment, social or material, may readily become in such matters; even the most superficial observer can not fail to notice the profound contrast which exists between the temperament of the Celtic-speaking and the Teutonic strains in these islands. These present almost the extremes of human development in such matters. They come to expression in every phase of religion or politics; they can no more mix than water and oil. The Irish and Welsh are as different from the stolid Englishman as indeed the Italian differs from the Swede. Far be it from us to



"BLACK BREED." Shetland Islands.

beg the question by implying necessarily any identity of origin by this comparison; yet we can not fail to call attention to these facts. There is some deep-founded reason for the utter irreconcilability of the Teutons and the so-called Celts. Our most staid and respectable commentators, the authors of the *Crania Britannica*, never weary of calling attention to it. Imagine an Englishman—choos-

ing one of their many examples of Welch characteristics—describing the emotional tumult of a marriage celebration by declaring that he “had never see sic a wedding before, it was just like a vunerel”!

The Welsh disposition or temperament is less familiar to us in America than the Irish; it is the exact counterpart of it. The keynote of this disposition lies in emotion. As vehement in speech as the Alpine Celt in Switzerland, France, or Germany is taciturn; as buoyant and lively in spirits as the Teutonic Englishman is reserved; the feelings rise quickly to expression, giving the power of eloquence or its degenerate prototype loquacity. This mental type is keen in perception, not eminent for reasoning qualities; “a quick genius,” as Matthew Arnold puts it, “checkmated for want of strenuousness or else patience.” As easily depressed as elated, this temperament often leads, as Barnard Davis says, to “a tumult followed by a state of collapse.” Apt to fall into difficulty by reason of impetuosity, it is readily extricated through quick resourcefulness. In decision, leaning to the side of sentiment rather than reason, “always ready,” in the words of Henri Martin, “to react against the despotism of fact.” Compare such an emotional constitution with the heavy-minded, lumbering but substantial English type, and one realizes the possible “clashing of a quick perception with a Germanic instinct for going steadily along close to the ground.” Ascribe it all to a difference of diet, if you please, as the late Mr. Buckle might have done; derive the emotional temperament from potatoes, and the stolid one from beef; or invent any other excuse you please, the contrast is a real one. It points vaguely in the direction of a Mediterranean blend in the Welsh and Irish, even to a lesser degree in the Highland Scotch. More we dare not affirm.

THE moderator of the recent General Assembly of the Free Church of Scotland, Dr. Hugh MacMillan, an eminent divine of undoubted orthodoxy, in his inaugural address before the assembly, said, alluding to scientific discoveries, that the scientific method had created a greater regard for truth than ever before existed in the world. The extraordinary exactness of the scientific method in the physical world has reacted beneficially upon the moral world, and has led to an intolerance of every form of falsehood. The scientific method is carried into theological studies, and men under its influence refuse to accept conventional or traditional evidence, and insist upon subjecting even the most sacred things to the most rigid investigation. Veracity is the passion of their life. In this way the influence of recent science in some directions and to some extent has been unsettling, but upon the whole it has been a great and permanent advantage. True religion can not possibly suffer from the tests and methods of science properly conducted.

ARE THERE PLANETS AMONG THE STARS?

BY GARRETT P. SERVISS.

THIS always interesting question has lately been revived in a startling manner by discoveries that have seemed to reach almost deep enough to touch its solution. The following sentences, fresh from the pen of Dr. T. J. J. See, of the Lowell Observatory, are very significant from the point of view of our inquiry:

“Our observations during 1896-’97 have certainly disclosed stars more difficult than any which astronomers had seen before. Among these obscure objects about half a dozen are truly wonderful, in that they seem to be dark, almost black in color, and apparently are shining by a dull reflected light. It is unlikely that they will prove to be self-luminous. If they should turn out dark bodies in fact, shining only by the reflected light of the stars around which they revolve, we should have the first case of planets—dark bodies—noticed among the fixed stars.”

Of course, Dr. See has no reference in this statement to the immense dark bodies which, in recent years, have been discovered by spectroscopic methods revolving around some of the visible stars, although invisible themselves. The obscure objects that he describes belong to a different class, and might be likened, except perhaps in magnitude, to the companion of Sirius, which, though a light-giving body, exhibits nevertheless a singular defect of luminosity in relation to its mass. Sirius has only twice the mass, but ten thousand times the luminosity, of its strange companion! Yet the latter is evidently rather a faint, or partially extinguished, sun than an opaque body shining only with light borrowed from its dazzling neighbor. The objects seen by Dr. See, on the contrary, are “apparently shining by a dull reflected light.”

If, however (as he evidently thinks is probable), these objects should prove to be really non-luminous, it would not follow that they are to be regarded as more like the planets of the solar system than like the dark companions of certain other stars. A planet, in the sense which we attach to the word, can not be comparable in mass and size with the sun around which it revolves. The sun is a thousand times larger than the greatest of its attendant planets, Jupiter, and more than a million times larger than the earth. It is extremely doubtful whether the relation of sun and planet could exist between two bodies of anything like equal size, or even if one exceeded the other many times in magnitude. It is only when the difference is so great that the smaller of the two bodies is practically

insignificant in comparison with the larger, that the former could become a cool, life-bearing globe, nourished by the beneficent rays of its organic comrade and master.

Judged by our terrestrial experience, which is all we have to go by, the magnitude of a planet, if it is to bear life resembling that of the earth, is limited by other considerations. Even Jupiter, which, as far as our knowledge extends, represents the extreme limit of great planetary size, may be too large ever to become the abode of living beings of a high organization. The force of gravitation on the surface of Jupiter exceeds that on the earth's surface as 2.64 to 1. Considering the effects of this on the weight and motion of bodies, the density of the atmosphere, the laws of pneumatics, etc., it is evident that Jupiter would, to say the very least, be an exceedingly uncomfortable place of abode for beings resembling ourselves. But Jupiter, if it is ever to become a solid, rocky globe like ours, must shrink enormously in volume, since its density is only 0.24 as compared with the earth. Now, the surface gravity of a planet depends on its mass and its radius, being directly as the former and inversely as the square of the latter. But in shrinking Jupiter will lose none of its mass, although its radius will become much smaller. The force of gravity will consequently increase on its surface as the planet gets smaller and more dense.

The present mean diameter of Jupiter is 86,500 miles, while its mass exceeds that of the earth in the ratio of 316 to 1. Suppose Jupiter shrunk to three quarters of its present diameter, or 64,800 miles, then its surface gravity would exceed the earth's nearly five times. With one half its present diameter the surface gravity would become more than ten times that of the earth. On such a planet a man's bones would snap beneath his weight, even granting that he could remain upright at all! It would seem, then, that, unless we are to abandon terrestrial analogies altogether and "go it blind," we must set an upper limit to the magnitude of a habitable planet, and that Jupiter represents such upper limit, if, indeed, he does not transcend it.

The question then becomes, Can the faint objects seen by Dr. See and his fellow-observers, in the near neighborhood of certain stars, be planets in the sense just described, or are they necessarily far greater in magnitude than the largest planet, in the accepted sense of that word, which can be admitted into the category—viz., the planet Jupiter? This resolves itself into another question: At what distance would Jupiter be visible with a powerful telescope, supposing it to receive from a neighboring star an amount of illumination not less than that which it gets from the sun? To be sure, we do not know how far away the faint objects described by

Dr. See are; but, at any rate, we can safely assume that they are at the distance of the nearest stars, say somewhere about three hundred thousand times the earth's distance from the sun. The sun itself removed to that distance would appear to our eyes only as a star of the first magnitude. But Zöllner has shown that the sun exceeds Jupiter in brilliancy 5,472,000,000 times. Seen from equal distances, however, the ratio would be about 218,000,000 to 1. This would be the ratio of their light if both sun and Jupiter could be removed to about the distance of the nearest stars. Since the sun would then be only as bright as one of the stars of the first magnitude, and since Jupiter would be 218,000,000 times less brilliant, it is evident that the latter would not be visible at all. The faintest stars that the most powerful telescopes are able to show probably do not fall below the sixteenth or, at the most, the seventeenth magnitude. But a seventeenth-magnitude star is only between two and three million times fainter than the sun would appear at the distance above supposed, while, as we have seen, Jupiter would be more than two hundred million times fainter than the sun.

To put it in another way: Jupiter, at the distance of the nearest stars, would be not far from one hundred times less bright than the faintest star which the largest telescope is just able, under the most exquisite conditions, to glimpse. To see a star so faint as that would require an object-glass of a diameter half as great as the length of the tube of the Lick telescope, or say thirty feet!

Of course, Jupiter might be more brilliantly illuminated by a brighter star than the sun; but, granting that, it still would not be visible at such a distance, even if we neglect the well-known concealing or blinding effect of the rays of a bright star when the observer is trying to view a faint one close to it. Clearly, then, the obscure objects seen by Dr. See near some of the stars, if they really are bodies visible only by light reflected from their surfaces, must be enormously larger than the planet Jupiter, and can not, accordingly, be admitted into the category of planets proper, whatever else they may be.

Perhaps they are extreme cases of what we see in the system of Sirius—i. e., a brilliant star with a companion which has ceased to shine as a star while retaining its bulk. Such bodies may be called planets in that they only shine by reflected light, and that they are attached to a brilliant sun; but the part that they play in their systems is not strictly planetary. Owing to their great mass they bear such sway over their shining companions as none of our planets, nor all of them combined, can exercise; and for the same reason they can not, except in a dream, be imagined to possess that which, in our eyes, must always be the capital feature of a planet, rendering

it in the highest degree interesting wherever it may be found—sentient life.

It does not follow, however, that there are no real planetary bodies revolving around the stars. As Dr. See himself remarks, such insignificant bodies as our planets could not be seen at the distance of the fixed stars, “even if the power of our telescopes were increased a hundredfold, and consequently no such systems are *known*.”

This brings me to another branch of the subject. In the same article from which I have already quoted (Recent Discoveries respecting the Origin of the Universe, Atlantic Monthly, vol. lxxx. pages 484-492), Dr. See sets forth the main results of his well-known studies on the origin of the double and multiple star systems. He finds that the stellar systems differ from the solar system markedly in two respects, which he thus describes:

“1. The orbits are highly eccentric; on the average, twelve times more elongated than those of the planets and satellites.

“2. The components of the stellar systems are frequently equal and always comparable in mass, whereas our satellites are insignificant compared to their planets, and the planets are equally small compared to the sun.”

These peculiarities of the star systems Dr. See ascribes to the effect of “tidal friction,” the double stars having had their birth through fission of original fluid masses (just as the moon, according to George Darwin’s theory, was born from the earth), and the reaction of tidal friction having not only driven them gradually farther apart but rendered their orbits more and more eccentric. This manner of evolution of a stellar system Dr. See contrasts with Laplace’s hypothesis of the origin of the planetary system through the successive separation of rings from the periphery of the contracting solar nebula, and the gradual breaking up of those rings and their aggregation into spherical masses or planets. While not denying that the process imagined by Laplace may have taken place in our system, he discovers no evidence of its occurrence among the double stars, and this leads him to the following statement, in which believers in the old theological doctrine that the earth is the sole center of mortal life and of divine care would have found much comfort:

“It is very singular that no visible system yet discerned has any resemblance to the orderly and beautiful system in which we live; and one is thus led to think that probably our system is unique in its character. At least it is unique among all *known* systems.”

If we grant that the solar system is the only one in which small planets exist, revolving around their sun in nearly circular orbits, then indeed we should seem to have closed all the outer universe

against such beings as the inhabitants of the earth. Beyond the sun's domain only whirling stars, coupled in eccentric orbits; dark stars, some of them, but no planets; a wilderness, full of all energies except those of sentient life! This is not a pleasing picture, and I do not think we are driven to contemplate it. Beyond doubt, Dr. See is right in concluding that the double and multiple star systems, with their components all of magnitudes comparable among themselves, revolving in exceedingly eccentric orbits under the stress of their mutual gravitation, bear no resemblance to the orderly system of our sun with its attendant worlds. And it is not easy to imagine that the respective members of such systems could themselves be the centers of minor systems of planets, on account of the perturbing influences to which the orbits of such minor systems would be subjected.

But the double and multiple stars, numerous though they be, are outnumbered a hundred to one by the single stars which shine alone as our sun does. What reason can we have, then, for excluding these single stars, constituting as they do the vast majority of the celestial host, from a similarity to the sun in respect to the manner of their evolution from the original nebulous condition? These stars exhibit no companions, such planetary attendants as they may have lying, on account of their minuteness, far beyond the reach of our most powerful instruments. But since they vastly outnumber the binary and multiple systems, and since they resemble the sun in having no large attendants, should we be justified, after all, in regarding our system as "unique"? It is true we do not know, by visual evidence, that the single stars have planets, but we find planets attending the only representative of that class of stars that we are able to approach closely—the sun—and we know that the existence of those planets is no mere accident, but the result of the operation of physical laws which must hold good in every instance of nebular condensation.

Two different methods are presented in which a rotating and contracting nebula may shape itself into a stellar or planetary system. The first is that described by Laplace, and generally accepted as the probable manner of origin of the solar system—viz., the separation of rings from the condensing mass, and the subsequent transformation of the rings into planets. The planet Saturn is frequently referred to as an instance of the operation of this law, in which the evolution has been arrested after the separation of the rings, the latter having retained the ring form instead of breaking and collecting into globes, forming in this case rings of meteorites, and reminding us of the comparatively scattered ring of asteroids surrounding the sun between the orbits of Mars and Jupiter. This Laplacean process Dr.

See regards as theoretically possible, but apparently he thinks that if it took place it was confined to our system.

The other method is that of the separation of the original rotating mass into two nearly equal parts. The mechanical possibility of such a process has been proved, mathematically, by Poincaré and Darwin. This, Dr. See thinks, is the method which has prevailed among the stars, and prevailed to such a degree as to make the solar system, formed by the ring method, probably a unique phenomenon in the universe.

Is it not more probable that both methods have been in operation, and that, in fact, the ring method has operated more frequently than the other? If not, why do the single stars so enormously outnumber the double ones? It is of the essence of the fission process that the resulting masses should be comparable in size. If, then, that process has prevailed in the stellar universe to the practical exclusion of the other, there should be very few single stars; whereas, as a matter of fact, the immense majority of the stars are single. And, remembering that the sun viewed from stellar distances would appear unattended by subsidiary bodies, are we not justified in concluding that its origin is a type of the origin of the other single stars?

While it is, as I have remarked, of the essence of the fission process that the resulting parts of the divided mass should be comparable in magnitude, it is equally of the essence of the ring, or Laplace, process that the bodies separated from the original mass should be comparatively insignificant in magnitude.

As to the coexistence of the two processes, we have, perhaps, an example in the solar system itself. Darwin's demonstration of the possible birth of the moon from the earth, through fission and tidal friction, does not apply to the satellites attending the other planets. The moon is relatively a large body, comparable in that respect with the earth, while the satellites of Jupiter and Saturn, for instance, are relatively small. But in the case of Saturn there is visible evidence that the ring process of satellite formation has prevailed. The existing rings have not broken up, but their very existence is a testimony of the origin of the satellites exterior to them from other rings which did break up. Thus we need not go as far away as the stars in order to find instances illustrating both the methods of nebular evolution that we have been dealing with.

The conclusion, then, would seem to be that we should not be justified in assuming that the solar system is unique simply because it differs widely from the double and multiple star systems; and that we should rather regard it as probable that the vast multitude of stars which do not appear, when viewed with the telescope, or

studied by spectroscopic methods, to have any attendants comparable with themselves in magnitude, have originated in a manner like that of the sun, and may be the centers of true planetary systems resembling ours. The argument, I think, goes further than to show the mere possibility of the existence of such planetary systems surrounding the single stars. If those stars did not originate in a manner quite unlike the origin of the sun, then the existence of planets in their neighborhood is almost a foregone conclusion, for the sun could hardly have passed through the process of formation out of a rotating nebula without evolving planets during its contraction. And so, notwithstanding the eccentricities of the double stars, we may still cherish the belief that there are eyes to see and minds to think out in celestial space.

ANIMATED PICTURES.

By J. MILLER BARR.

A NEW and wonderful field in the realm of photography has lately been opened up to the world—a field whose extent, variety, and richness are as yet scarcely realized, though its assiduous cultivation by inventive minds has already afforded a harvest of interesting results.

The nature of this new domain is pointed out by the title of our present sketch. Aided by ingenious devices, the scientific photographers of to-day are enabled to portray motion in all its varied forms with a realism that impresses the beholder. They have, in effect, contrived to breathe life into normally changeless records of the camera; and the process is now applied, with marked success, to animated scenes of the most diverse description. The busy traffic of city streets, the play of expression upon the human countenance, the movements of waves, waterfalls, fleeting clouds—these and many other effects have been depicted upon the screen with equal fidelity before audiences that have seldom failed to show their appreciation of the novel form of entertainment thus provided.

It is true that these “motion views” are subject to certain imperfections. Apart from the flashing or pulsating effect * which distinguishes the pictures, there are frequent blemishes, arising in part from mechanical, in part from photographic and other causes.

* This effect can be got rid of only by considerably increasing the *rate per second* at which the individual pictures are shown. When, however, this rate is as high as forty or fifty per second of time, the light-pulsations are hardly noticeable, and can not be said to mar the pictures in any appreciable degree.



SECTION OF FILM (actual size).
A squad of soldiers at drill.

Chief among these causes must be mentioned the use of faulty apparatus and of films of inferior quality, or which have become worn by frequent and prolonged use. Minor blemishes are, however, of common occurrence, even when the best obtainable apparatus and materials are used for the purpose. These are referable chiefly to defects in the sensitized films of celluloid. But there is no reason to doubt that better films can be produced, and that pictures of this nature will ultimately be rendered as free from defects as are ordinary stereopticon views.

Meanwhile, these striking productions of the photographic art will doubtless continue to attract the world's attention. They have already become a source of much instructive entertainment to the public; and their usefulness, from this point of view, must be recognized by all. But the invention has other and more serious claims upon our consideration. As a means of permanently recording and vividly illustrating notable events its importance will scarcely be overestimated. The ordinary photography can depict for us only isolated phases in the varied phenomena of life or Nature; though the value of its precise records, from the historian's standpoint, has of course received ample recognition. But the charm of animation may henceforth be added to our portrayals of historic scenes. And, in like manner, we shall be enabled to record the mutable expressions, the gestures and mannerisms, as well as the features, of distinguished men and women; while the value of all such records must increase with the lapse of time. These aspects of our subject are, indeed, so attractive that one is tempted to dilate upon them at some length; but I shall content myself with a brief allusion to one recent event in which the whole world has evinced keen interest—viz., the

celebration of the Diamond Jubilee of Her Majesty Queen Victoria. The Royal procession and other imposing features of the jubilee ceremonials were duly recorded upon cinematographic films, of which fine specimens were set aside for future preservation in England's National Museum. These have been "hermetically sealed and deposited in the museum, together with a machine and lantern, by means of which they may be exhibited to future generations."

We can only strive to realize, in some dim measure, the fascination which those pictured ribbons of celluloid will exercise upon the eyes and minds of future Londoners—let us say, at some remote epoch, when the throne of Great Britain will be occupied by a monarch of whom we can form no conception, under social conditions which may differ widely from those existing at the present day.

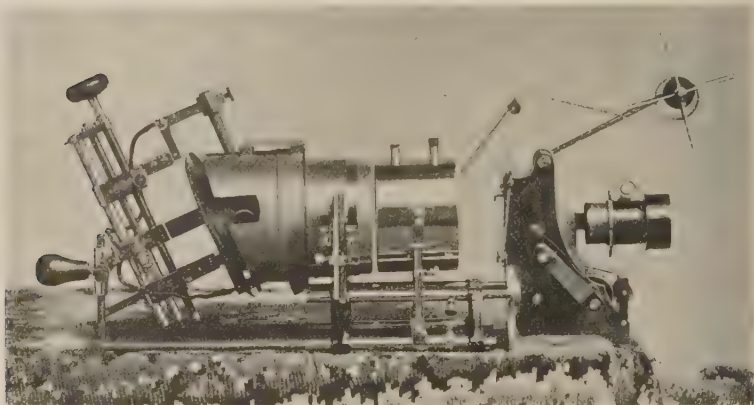
I have thus far alluded only to the more obvious uses of this beautiful invention. But the subject, as we shall presently see, may be regarded from two very distinct points of view. On the one hand, we are concerned with the ordinary animated pictures, whose properties and functions are already known to the public; on the other, we have to deal with movements *originally imperceptible to the eye*, but which can be rendered visible upon a screen if the slow-moving bodies are photographed under conditions described in a subsequent part of this article. Pictures of this kind may, for convenience, be spoken of as *motion views of the second type*. Such pictures have not, I think, been produced up to the present time. But this aspect of the subject, though hitherto neglected (if not wholly overlooked), is deeply interesting and merits the most careful investigation. It will, accordingly, engage our especial notice, though the reader will first be led to consider in a general way the methods and principles upon which depend the production of ordinary animated photographs.

Although the kinetoscope and cinematograph are regarded as distinctively modern contrivances, it should be borne in mind that they represent only the recent development of a principle that has long been familiar to students of optical science. They are the descendants, so to speak, of more primitive forms of apparatus, among which may be specially mentioned the zoetrope and the phenakistiscope. The latter instrument—an optical toy devised by the famous French physicist Plateau—merits particular notice, since it apparently represents the first stage in that process of evolution which has led up to the elaborate motion-picture machines of the present day.

Though differing much in the details of their construction, these various machines are designed to fulfill the same general purpose—

viz., the display in rapid sequence of a long series of photographs, which hence convey to the eye and brain the impression of a continuous and animated scene. In the kinetoscope the small pictures are viewed through an enlarging lens by reflected light, whereas in the cinematograph, phantoscope, vitascope, etc., they are projected upon a screen—a plan that is obviously best suited to the requirements of a public exhibition.

A machine of the last-mentioned type may be shortly described as a stereopticon, combined with such mechanism as is requisite for the precise manipulation of the celluloid picture film.* When the



MACHINE FOR PROJECTING ANIMATED PICTURES ON THE SCREEN. The phantoscope, latest model, being an attachment for a J. B. Colt & Co. electric lantern.

apparatus is set in motion the long band of celluloid passes quickly, though not continuously, behind the projecting lens, between spools or bobbins which revolve at a uniform rate. While thus passing from its original spool to the winding reel the film encounters certain pulleys and toothed rollers that serve to accurately direct its movements. Along its edges are numerous small perforations,† into which the teeth of the rollers fit with precision; and by this means the small transparencies are made to occupy exactly similar positions when their images are projected upon the canvas. As each picture in its turn attains this critical position, it is momentarily brought to

* See accompanying illustration of the phantoscope. For this picture, and for the other photographs here reproduced, I am indebted to Mr. C. Francis Jenkins, of Washington, D. C., inventor of the phantoscope, and the author of various notable improvements connected with this branch of photography.

† These small square holes—usually six or eight for each picture—are punched out with great precision by a machine made for the purpose. They insure correct register, not only in exhibiting but also in “printing” the photographs.

a standstill. At the same time a shutter * is opened and an image of the picture flashes for an instant upon the screen. The shutter is then quickly closed, the picture resuming its motion, while its successor in the series is brought into a similar fixed situation.

This temporary stoppage of the film (or rather of a portion thereof), as each picture attains its proper place behind the projecting lens, is a very essential feature of the process. It is effected by various ingenious devices, among which those of Acres, Edison, and the Lumière brothers are deserving of special notice. Without, however, attempting to describe these diverse forms of apparatus, I will try to indicate in general terms the means by which an intermittent motion of the film is secured. Let us assume that a picture has arrived at the fixed position already referred to. At the instant of its arrival, a portion of the film on the *preceding* side of the picture will be in an unstrained or slack condition. The "slack" is then taken up by a continuously moving sprocket pulley, whereupon a rod or roller is quickly brought to bear against the now tightened film, pressing it to one side and as quickly releasing it. By this movement the next picture is pulled into its fixed position, while the film is made taut (or nearly so) on the *following* side of this picture. These operations are repeated continuously until the entire film has passed through the holding device in rear of the lens. The process may be compared, in a general way, with the automatic feeding of a web of paper to an ordinary printing press.

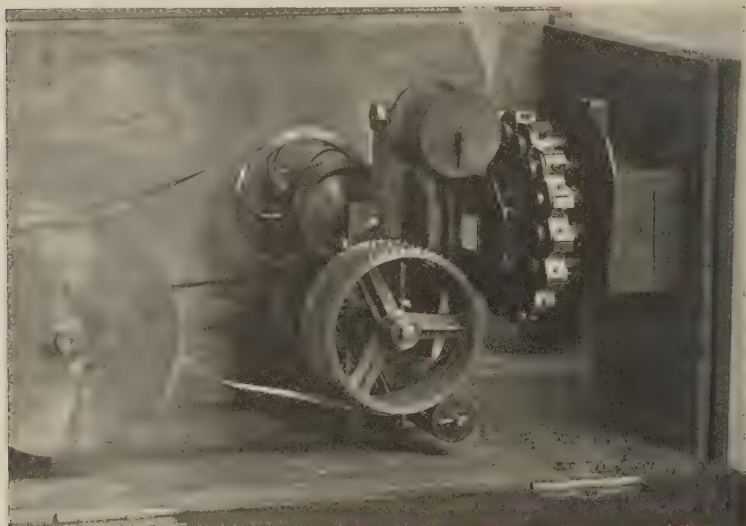
A specially constructed camera is used in taking the negatives from which ultimately motion pictures are obtained. This camera is provided with mechanism generally similar to that employed in showing the photographs.† Indeed, the selfsame mechanism has frequently been used for both purposes. The picture roll is replaced by a reel of sensitized film, upon which the exposures are made in quick succession when the apparatus is set in motion. From twenty-five to fifty photographs are thus "laid on" in a second of time. The films range in length from fifty to two hundred feet, and contain when finished from eight hundred to more than three thousand tiny negatives.

After exposure the film is subjected to the usual photographic operations. These are, however, conducted with special arrangements, rendered necessary by the inordinate length of the film. The latter is subsequently made to pass, in contact with a second

* In some forms of apparatus, such as the vitascope and phantascope, the shutter is omitted. The intermittent motion of the film does not seem to mar the continuity of the pictures, which are also more fully illuminated in the absence of a shutter.

† The Jenkins camera (see illustration) forms an interesting exception to this general rule.

sensitized film, beneath an incandescent lamp, whereby the photographs are impressed or "printed" upon the sensitive surface. This second film in its turn is passed through the various photographic processes. When complete, it is wound upon a spool, and is then ready to be placed in the cinematograph or other machine used in exhibiting the pictures. Here, as already stated, the mechanical arrangements correspond to those employed in taking the negatives.



THE JENKINS CAMERA, with rotating system of lenses; capable, in sunlight, of taking one hundred pictures per second.

Thus the pictures, when displayed before an audience, are seen to flash out in the same rapid sequence in which the original scenes were presented to the "eye of the camera."

A homely illustration may aid the reader in arriving at a perfectly clear comprehension of this subject. Let us take the case of a man who is slowly walking past a high picket fence and gazing intently at some moving object on the other side of the fence. His view will be interrupted at regular intervals by the pickets as they successively encounter his line of sight. But if he proceed more quickly a seemingly continuous view of the object in question will be obtained, though rapid alternations in its *brightness* will be manifested. These effects are due to a well-known cause—viz., the persistence of luminous impressions upon the human retina. Thus, our observer's eye retains for a brief period its impression of each momentary glimpse that is afforded him under the conditions just described; and the successive visual images become merged into one

another, while the rapid fading of these retinal impressions gives rise to the pulsating effect that is familiar to everybody.

Now, the well-known optical phenomena which I have here attempted to describe are, in fact, closely analogous to those exhibited by the animated pictures.* In the former case we have to deal with a moving body; in the latter, with photographs of such bodies; and since the momentary images in the first-mentioned case are practically changeless, it is evident that a similar general effect must be produced upon the organ of vision.

We have hitherto been concerned with motion pictures of the ordinary type—those, namely, which reproduce with accuracy the movements of the original scenes. In order to secure this result it is essential that our pictures be “taken” and exhibited *at the same rate* per unit of time. Where this condition has not been fulfilled, it is manifest that the pictured objects must appear to move either quicker or more slowly than their originals. If the difference in rate be small, its results will hardly be noticeable; if large, a curious but awkward and unnatural effect will be produced.

Suppose now the mechanism of our camera to be altered in such wise that successive exposures may be made at relatively long intervals of time, while the duration of each exposure can be varied at will. With this end in view, the camera should be provided with clockwork capable of running for twenty-four hours continuously. Thus equipped, we should be ready to experiment on objects—such as growing plants—whose changes are of too gradual a nature to be perceived by the eye.

An ordinary house plant—let us say a geranium, abutilon, or hyacinth—would form an admirable subject for the purpose. The photographs might be taken under the electric light † at intervals of an hour or more, though plants of rapid growth (such as climbers) might well be photographed at much shorter intervals. As a uniform illumination is essential, it would be necessary to exclude daylight while taking the negatives. At night the light source could be maintained continuously—a condition which tends, as is well known, to stimulate the growth of plants. The experiments might extend over a period of weeks, or even of many months, according to the nature of the plant selected. But the resulting film, when placed in the cinematograph for exhibition, would be “reeled off”

* The analogy will be rendered more exact if we assume that *one eye only* is used by our observer in viewing the moving object. Binocular vision would modify, to a perceptible extent, the appearances presented.

† An incandescent lamp would probably give the best results, though gas or oil flames could evidently be utilized.

in the course of a minute or two,* so that we should have, as it were, a greatly *magnified* representation of the movements involved in plant growth. If, for example, our pictures were taken at half-hourly intervals, and shown at a speed of fifty per second, the apparent rate of growth of the plant would be increased no less than ninety thousand times. A slower rate would evidently correspond to a diminished time interval between successive negatives; and this interval should in all cases be so chosen as to insure gradual (though distinctly perceptible) changes in the resulting pictures.

Such views could not fail to produce an effect at once marvelous, unique, and instructive. As pictured upon the canvas, the plants would grow and develop before the eyes of onlookers, throwing out leaf upon leaf, and visibly increasing their dimensions. Here and there a flower or flower cluster might make its appearance, the individual blossoms bursting forth suddenly and remaining visible for a brief period only. The process is clearly applicable to greenhouse or indoor plants of every description, from stately palms or tree ferns down to the most delicate mosses or lichens. Thus, the general phenomena of plant growth may be illustrated with a vividness never before realized. As object lessons in botany, such motion pictures would be invaluable, while the general public, not less than the advanced student of science, would regard them with feelings of the keenest interest.

Instead of photographing an entire plant, we might direct our efforts to the representation of its more interesting details. Thus, an expanding leaf bud or a flower stalk would furnish highly attractive views for the cinematograph. The microscope, too, could be brought to bear, and with its aid we should be enabled to depict the more delicate and subtle processes of vegetable growth. Such optical studies would be not merely instructive in the ordinary sense of that term, but they would be likely to throw new light on biological problems of the deepest interest. For we are here concerned with changes which can not be directly observed, and whose nature can only be imperfectly apprehended from a comparison of ordinary photographs taken for the purpose. We know, for example, that common instantaneous views of men or animals in motion convey a most imperfect idea of the *actual movements* involved in walking or running; and a similar remark would doubtless apply with greater force in cases where the pictured objects were undergoing changes of a complex physical nature; so that the human eye, aided by the sensation of motion, might well succeed in bringing to light laws or relations hitherto unrecognized by botanists.

* Although the motion views do not commonly endure beyond these limits, it should be noted that a much longer duration—involving the use of many films—is now practicable.

This graphic method should theoretically be applicable to insects and animals as well as to plants. In practice, however, it can be successfully applied only to the lower and the higher forms of animal life. On the one hand, we could picture the growth of certain lowly organisms in the border land between the animal and vegetable worlds; on the other, we could portray the development of a child, or even the life changes of a human being from childhood to old age. Pictures of the latter class may evidently be taken at daily intervals; uniformity in position and expression, as well as in the clothing or drapery of the subject, being essential requisites to success in all such cases.

In dealing with subjects of this nature we must take into account the inevitable deterioration of the sensitive films through lapse of time. It will become necessary, in fact, to use *shorter* films whenever the negative series is much prolonged. Such films could be treated separately, and afterward joined together so as to form one long strip—a procedure involving only the exercise of a little care and the use of some celluloid solution. From this composite negative film a single uniform roll of pictures would ultimately be obtained by the usual process.

The application of this method to outdoor objects will in general be greatly restricted, owing in part to the variable light and partly also to the influence of wind and weather. Some picturesque effects could, however, be obtained by photographing natural scenery under varying angles of solar illumination—especially in mountainous regions and near the time of sunrise or sunset, when the most striking changes would be manifested. Seasonal variations, too, might be illustrated by depicting scenery in a forest from day to day for months in succession. Owing to the gradual nature of



AN APPROACHING TRAIN.
Compare upper and lower views
of the film.

such changes it would be practicable to take several negatives at about the same hour of each day, an actinometer being used, and the exposures varied in accordance with its indications. The operations might thus be omitted during bad weather, an additional number of photographs being taken on succeeding fine days. Some very pleasing views for the cinematograph could without doubt be obtained by this mode of procedure.

Turning now from the earth to the heavens, we shall see that similar methods are applicable to the most prominent of celestial bodies—viz., the sun. The photographic art has long since been applied with conspicuous success to the glowing solar disk, with its dark spots and brighter patches or “*faculæ*”; and such photographs are now taken from day to day at leading observatories in various parts of the globe. During recent years, moreover, astronomers have contrived to photograph, under ordinary conditions, the surroundings of the great luminary—including the chromosphere and prominences, but excepting the corona, which can not as yet be studied in the absence of an eclipse.

I shall not attempt to describe the many interesting features shown in such photographs; nor is it necessary in this place to indicate the precise means whereby solar picture films can be produced. The chief point to be noted is that changes—often of a rapid and striking character*—are continually occurring both in the sun’s photosphere and its gaseous surroundings. The cinematograph will enable us to actually *see* such changes taking place; and it may be possible in this way to obtain new light on certain fascinating, though recondite, problems presented by the sun, while the complex solar movements may in any case be pictured in a manner that can not fail to prove deeply interesting and instructive.

Although the common motion views are often described as realistic, there are two respects in which they fail to correctly represent the original scenes. Not only do they lack the charm of color (which adds so much to the variety and interest of ordinary scenes), but the effect of solidity, due to our binocular vision, is also absent. As regards the reproduction of color, we shall have to rest content—at least for some time to come—with monochromic views of *ordinary* moving objects. Instantaneous photography in colors is not yet possible, nor is it likely to be achieved in the near future. In the color process of M. Lippmann, for example, it is necessary to expose the sensitive plates for relatively long periods of time. It may be questioned, also, whether such photographs could be successfully produced upon celluloid films. And even if these objections were re-

* We are here concerned with movements which, though invisible to the observer’s eye, take place in reality with very great rapidity.

moved, there would remain another serious drawback—viz., that such pictures must be viewed by reflected light, and hence can not be projected upon a screen in the usual way.

But there are other methods of obtaining colored pictures which merit careful consideration from our present point of view.* One of these methods is so clearly applicable in the production of motion views of the second type that I need offer no apology for the brief account of it given below:

A camera fitted with special apparatus—including three carefully selected color screens—is used in taking the negatives. The arrangements are such that three separate images—red, blue, and green-yellow—of the scene or subject are thrown upon the sensitive (isochromatic) plate. The result is a triple negative, from which a transparency is obtained by the usual procedure. If now this transparency be placed in a lantern provided with a triple objective and with color screens similar to those used in taking the pictures, the three colored images of the transparency may be brought into coincidence upon the screen. And since the tints of the glasses correspond to the three primary color sensations, a picture in natural hues will be thus produced. The process, in its perfected form, is due to Mr. Frederic E. Ives, of Philadelphia, who has in this way been able to reproduce the colors of flowers and of natural scenery with complete success.

Now, there is no reason to doubt that similar results can be secured by using films instead of glass plates; so that Mr. Ives's ingenious system (or some modification thereof) may probably be adapted for use with mechanism similar to that of the cinematograph.

We may thus hope to obtain striking and beautiful representations of plant life, in which not only the forms and movements of leaves, stalks, or flowers, but also their glowing colors, will appear upon the canvas.

The realism of our motion pictures may also be enhanced by imparting to them the quality of relief, as in the stereoscope. We may utilize for this purpose a clever invention known as the lantern stereoscope,† whereby stereo views can be shown upon a screen, the pictures being viewed through instruments resembling opera glasses in external appearance. It will be possible in this way to exhibit animated views of every description in distinct stereoscopic relief. Each member of the audience must, of course, be provided with one of the binocular instruments above referred to; and it is almost need-

* It is too soon, as yet, to express any definite opinion with respect to the new Dansac process and some other heliochromic methods of recent origin.

† The principle of the polarization of light is effectively utilized in this very ingenious contrivance.

less to add that the projecting machine, as also the camera used in taking the stereo negatives, must be of duplicate construction.

The phonograph—or graphophone—has frequently been used in combination with machines for the production of motion views. By such means Edison hoped to reproduce the sounds accompanying many scenes with such perfection that it would be possible to represent, for example, the complete performance of an opera or a drama, with all its accessories. Up to the present time, however, these anticipations have not been realized. The rich song notes of a Patti or a Melba can not yet be satisfactorily stored up in the phonographic cylinder, to be given out when required with the full tone and perfect expression of the artist. But better things may be looked for in the near future, and it is probable that Edison's attractive scheme will, sooner or later, be carried into effect.

In an ideal exhibition of this nature we should see the animated views appear upon the screen in relief and in their natural tints, while the sounds appropriate to certain scenes would be reproduced with as much fidelity as the optical impressions. Much remains to be done before this ideal can be fully realized; but in the meantime it will be possible, with our present resources, to make some progress in this direction, and to obtain pictures of a novel and instructive type, by proceeding along the lines which I have attempted to define in the present article.



PROCESSES OF CILANGE IN PRONUNCIATION.*

By MICHEL BRÉAL,

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PROFESSOR OSTHOFF, of the University of Heidelberg, has said that phonetic laws are blind and operate with a blind necessity. If, instead of this, he had said that these laws are constant so long as they are the effect of our habits, and that our habits, where nothing contradicts them, are manifested uniformly and regularly, he would have uttered an incontestable truth. But we do not think they are fatal or blind.

Phonetic changes start from one person. If they are not accepted, they remain without effect and are soon forgotten.

At such an age as ours, with a settled tradition of pronunciation, with our schools and academics, the individual has little power. But it has not been so always and everywhere. Suppose that, among

* An address delivered at the institution of the Laboratory of Experimental Phonetics in connection with the Collége de France.

a barbarous people, a man of authority and influence, whether by physical defect or from some other cause, commits a fault in articulation. It is imitated, in the family first, and then among the relatives and neighbors. The peculiarity of pronunciation spreads, and is more marked as it spreads; and if nothing occurs to interfere with it, a phonetic change is accomplished. But is there anything fatal in that? The change is very like those which take place in costume, or armor, or in the house; a historic fact, having neither more nor less of the character of fatality than other historical facts. It is true that if we go back to the initial cause we find on final analysis a movement of the vocal organs; but in what act of our life are not our organs the final motive? To assume fatality, it would be necessary to suppose that on a certain day the organs of speech of all the individuals of a group should be modified in the same manner.

There is a reason why the phenomena of language should be specially subject to imitation. Being a medium of communication, it would lack its essential condition if it varied as between one person and another, and would lose its right to be. Hence the necessity of a uniform pronunciation. But this is clearly a matter of social necessity, not of a physical fatality.

A phonetic change may be adopted; or it may be rejected, after a longer or shorter struggle; for peoples are composed of individuals who are not all of the same age, or of the same sex, or of equal education or social position. In the sixteenth century the Parisians were agreed in pronouncing *s* as *r* and conversely *r* as *s*; *Paris* became *Pasis*, and *oiseau* (bird) became *oireau*. The poet Marot made this matter the subject of a satire. The usage was contested as a ridiculous affectation, and went out, but not without leaving vestiges. The thick utterance of the incredibles of the Directory is another example of a merely passing fashion.

These fluctuations explain the otherwise incomprehensible variations of geographical maps of dialects. If we make linguistic charts of France in the twelfth, thirteenth, fourteenth, and sixteenth centuries, we shall find boundaries changing, one province growing larger, another smaller, and reverse changes perhaps taking place in the following period. Revolutions occur much like those of political power, but the two do not always coincide.

Phonetic changes may therefore be tracked. The interchange of *s* and *r* is thus traced from its beginning in Roussillon northward through France, till it reached the Norman islands; a second substitution of Germanic consonants, which established a difference between High German on one side and Low Dutch, English, and Scandinavian on the other, passed from south to north to the fifty-first and fifty-second degrees of latitude. The fact is thus explained

that linguistic classifications are usually in harmony with geographical conditions. The Pushtu (Afghan language) forms a medium between the Indian and the Iranian; the Arcadian (ancient Greek), between the three Æolian dialects; the Greek, an intermediate point between the Persian and the European languages. The Sardinian is halfway between Italian and Spanish.*

There is no absolutely pure dialect. Every population is mixed, has relations with its neighbors, and receives immigrations from abroad. A nation is never isolated, or a province, or a village; but, on the other hand, the closer the boundaries are drawn up, the more frequent are the exterior relations, because the distances to be traversed are less and the means of making one's self understood are easier. Unity is not found even in the family, whose members are in contact with the outside world, but not all in the same way. And finally, when we come to the individual, we have unity of pronunciation and phonetics no more, for we do not speak or pronounce in the same way when we address a single one or many, when we are cool or under the control of passion, when in full vigor and freshness or at the end of a day's work. Nor do we do so when addressing a superior or an equal, for conversation is essentially a work of collaboration, and our interlocutor must have his part in it. We sometimes hear it said of some one that "he knows how to speak to a crowd." All these circumstances modify pronunciation.† The supposed phonetic purity of dialects will therefore have to be considered one of the fancies of linguistics.

The words of the same dialect do not all obey exactly the same phonetic laws. The matter is controlled in part by the principle of frequency. Words which we pronounce more frequently are by that very fact pronounced with greater facility; and pronouncing them more easily, we give less attention and effort to them. Examples of this effect of recurring use of words are furnished in the names of persons and places and in exclamations. Words become more subject to alteration as we pay less attention to the meaning of the different elements of which they are formed. As long as we perceive clearly the significance of the two parts of a compound, that compound remains intact. But from frequency relaxation of attention results, or rather the several parts cease to be distinct to the mind, and the whole takes on the value of a single sign, and phonetic alteration has free scope.

Agglutinative languages, like the Hungarian, are less exposed to alteration than inflectional languages, for each element has a distinct

* J. Schmidt, *Vokalismus*, ii, 182. Schuchhardt, *Vulgär Latein*.

† This is well understood in the theater, and we may learn much from actors on this subject.

value which remains present to the mind. It would be a mistake to judge of the perfection of a language by the degree to which it has preserved the constituent elements of its words. The language performs greater services the further it is removed from its primary origin. A word is most perfect when it has reached the condition of a simple sign, letting the idea be perceived clearly without obscurity or refraction. Under all these considerations the laws of phonetics are not blind. It may be remarked, for example, that substantives change more readily than adjectives, participles, or adverbs, because the substantive passes more promptly to the state of a simple sign.

It is affirmed by M. Brugmann that the change in pronunciation starts in the organs before it affects the words; but we can not accept it except in pathological cases. A child born with defective organs will hear and pronounce particular sounds wrong; but this fault, recognized as arising from some deficiency of conformation, has no influence on the development of the language. No matter whether it is corrected or not, nobody imitates it. Minute changes, on the contrary, which in the beginning modify the articulations so slightly that their influence can hardly be perceived, are the important ones, because they are contagious and keep growing larger. It is by changes of this kind, continuing and increasing from generation to generation, that words become shortened, syllables and letters are lost out of them, and the pronounced word becomes so different from the spelled one as to excite remark. In nothing else do we find better illustrated what a modern writer calls the little forces—forces which in the course of ages have differentiated the words of half a dozen languages from their native origins, and have marked the distinctions between the Germanic tongues.

If these changes originated primarily in modifications of the organs, the sounds undergoing the transformations would disappear from the language. Yet we find that the same sounds which are regularly transformed in a larger proportion of words are still maintained in some. Hence the cause of the changes can not be found in modifications of the organs. We still pronounce *k* in the same way and with the same organs as in the Roman period, although in many of the words in which it once figured it has become *ch*.

We may obtain some light as to the origin of these phonetic changes by studying a similar phenomenon in writing. The hieroglyphics on the earliest Egyptian monuments are veritable drawings of definite objects. The same signs are found on more recent monuments, but traced as in a current hand, in which the engraver or scribe only indicated the contours. It is very evident that the hand of the scribes had undergone no modification, and that their

sight had not changed. Still less had the hieroglyphics gone out of use. The real and only cause of change was that the minds of the people had with the lapse of time become more accustomed to these characters, and that an abridged indication of them was sufficient to make them legible. It was therefore unnecessary to reproduce the detail of the figures, and all that was not essential was omitted. If the line of characters always presented an identical text, one of those unvarying formulas found in all languages, the abbreviations of the design would be still bolder. The hand and the eyes could easily run over these lines, the contents of which were known in advance.

The prime cause of phonetic changes is therefore mental. The word is a sort of vocal image impressed in the memory, the more or less complete reproduction of which is committed to our organs. The mind gradually familiarizes itself with this image, and no longer takes the same pains in reproducing it accurately, for it is sure of being understood. The will ceasing to watch over the organs, they follow their propensities. But if exactness becomes necessary, a slight effort of will is effective, the old consonants appear again, the contracted syllables resume their places, and we hear the word in its primary integrity.

While we have drawn our comparison from hieroglyphics, any movement directed by the will might have furnished a similar analogy. If we make the same gesture twenty times in succession, it will probably be less marked the twentieth time than the first.

Passing from one insensible change to another, it may happen that some sounds will quite disappear from the language, as has occurred, for example, with the liquid *l* in Zend, where it has been absorbed in *r*. If the organs in such cases seem incapable, it is not because they are different, but because they lack practice. If a Parisian youth is trained by an English governess, he runs the risk of having an English accent in speaking French. This does not prove that the conformation of his organs is peculiar, but that language has as much to do with making the organs as they with making language.

A third axiom is that the scale of sounds is never returned upon; that is, that when an articulation is once modified, it is never restored in its primitive purity. The habit of the Latin language is to contract its words; but *domnus* is at least as old as *dominus*, *Hercles* as *Hercules*, and *valde* as *validus*; and in inscriptions of the time of the empire, we find *discipulina* for *disciplina*, *tempuli* for *templi*, and *liberitas* for *libertas*. Change of *s* into *r* is one of the most general rules of Latin. But this change could not impose itself upon certain proper names, which fidelity or the taste for archaism

maintained in their primitive form (*Numisii*, *Papisii*, *Fusii*). Speaking metaphorically, we might say that people avoided pronouncing these names in the same free-and-easy manner as the rest of the language. The law of substitution of Germanic consonants, which is usually taken as the type and model of phonetic laws, presents occasional examples of sounds returned upon. It would, however, be in our opinion a mistake to offer the substitution of the Germanic consonants as a fact that was accomplished at a given moment in the history of the Indo-European languages, and the direction of which can be fixed within the limits of two dates. Substitutions were going on all through the middle ages, as is shown by the manner in which Latin words are written in German, and is still going on, as may be perceived when a Bavarian or a man of Würtemberg talks French. Accustomed by the usage of their own language to a certain way of pronouncing the explosives, they carry the habit everywhere.

As to the origin of this phenomenon, it is hardly credible that a population should have agreed to disfigure the sounds of their language by substituting, according to their whim, hard sounds for soft, aspirates for hard sounds, and soft sounds for aspirates. It is easier to comprehend that an alien people, adopting an Indo-European language, should have brought to it the habits of its native pronunciation. A second substitution of consonants, which proceeded from the south of Germany northward, corresponds probably with a new afflux of foreign population, which, bringing similar habits of pronunciation to an idiom already once transposed, displaced the consonants in a new degree, but still in the same direction. The difference between the High German and the Low German and Scandinavian idioms may be explained in some such way as this.

A fourth and last principle of phonetic changes is that they are effected according to the law of least effort. In view of the causes already considered, the tendency of language is to economize effort, and consequently to replace sounds that exact some degree of energy with weaker sounds. Thus the Latin labials *p* and *b* become *v* in French; some letters cease to be pronounced; and assimilations take place in groups of consonants. If we should listen to a Roman of the second or third century from the foundation of the city, we should probably be surprised at the energy of his pronunciation and the intensity of his articulations. Yet it would be incorrect to take this as a constant rule. The shortening and the softening down of words do not always result in diminution of effort. New groups of consonants are formed in the course of changes, which do not require less expenditure, but sometimes more. Reduction of time is thus often attained at the cost of increase of effort.

Among other observations which escape the ordinary rules of assimilation or weakening are those lately studied in the book of Meringer and Meyer on Faults of Speech, in the shape of metatheses, confaminations, articulations, etc., one class of which consists in the interchange of consonants by shifting them from the syllables to which they belong to others, so that the displaced consonant takes the position of the one that has displaced it. Such steps taking place in an idiom without literature or education are as contagious as the others. It is in this way that the root *spek*, which gives the Latin *spectare* and the Sanskrit *spak*, is in Greek *σκεπ*, whence *σκέπτομαι*, *σκοπός*, *σκοπέω*), and in French the Latin *scintilla*, which should make *échintelle*, has given *étincelle*. The vocal image has been reversed.

In the laboratory of experimental linguistics which has been instituted in this college, these phenomena of phonetics will be subjected to a scientific study, the articulations of individuals will be examined at the moment they are made in the mouth; and by means of the instruments of Edison and Marey we shall be able to write the sounds, or rather they will write themselves, so that they will offer to the minute and protracted observation of the eye what the ear necessarily perceived in a confused and fugitive way; and thus a whole order of research and discovery is opened to linguists, however little taste they may have for physics and the natural sciences.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

In a book recently brought to light, *De Naturis Rerum*, or Concerning the Nature of Things, by one Neckham, who was some time in the late twelfth or early thirteenth century a professor in the University of Paris, the game of chess is treated entirely as a military diversion. The actions of the several pieces are compared to the military deeds of the heroes of old or to strategical devices in war. There are other evidences that it was played in Europe ordinarily or chiefly by soldiers. Among them is the presence of the chess rook (castle) in the coats of arms of twenty-six English families. It was discouraged by ecclesiastics about Neckham's time as a vanity and source of quarrels. One council, in fact, went so far as to order clerks excommunicated who indulged in it. For the same reasons John Huss is said to have deplored that he ever learned it. Neckham's account of the game includes a story of Louis the Fat, of France, who, when fleeing from Henry I, of England, killed a soldier who had caught his horse by the reins, saying that the king could never be taken, even in chess; and tells of several sanguinary feuds, with the loss of many lives, being occasioned by Reginald Fitz Ayman slaying a nobleman in Charlemagne's palace with a chessman. Neckham's book is a very curious one, covering most of the lore of his time, and treats of poetry, biblical criticism, astronomy, popular myths, birds, fishes, the structure of the earth, trees, compasses, fountains, animals, and many other subjects.

PRINCIPLES OF TAXATION.

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XIII.—THE EXISTING METHODS OF TAXATION.

(Continued from page 17.)

DISTINCTION BETWEEN "REAL" AND "PERSONAL" PROPERTY ARTIFICIAL AND NOT NATURAL.—As a further help to the understanding of the subject, it is important to here call attention to the circumstance that the distinction between real and personal property is, to a very great extent, an artificial and not a natural one, and that there is not only no common or accepted rule for their definition and distinction, but, on the contrary, a great diversity of statute enactment by the different States of the Federal Union and by foreign governments on the subject. (For abundant illustrations in proof of this statement, see *Popular Science Monthly*, vol. li, No. 5, pages 607, 609.) "The statute laws on the subject of taxation in the United States," says Mr. Hillard, in his *Law of Taxation*, "is as voluminous as the constitutional provisions are few and concise." With a general similarity, the laws of the different States are very diverse; and so numerous and frequent are the changes that the author disclaims any responsibility in his book for the implied statement that "the law of any particular State, however recent, is now in force."

The attempt, therefore, to recognize in a system of laws a distinction in respect to the so-called personal property that is perfectly arbitrary, and which forty-eight sovereign States of the Federal Union may alter at pleasure, is very likely to give a general result somewhat akin to that obtained by an artist who, in painting a landscape, selected a cow as his fixed point of perspective. If the cow had remained quiet, the picture might have been satisfactory; but as the cow walked off, the details of the picture were not harmonious.

VALUE RELATIONS OF LAND AND PRODUCTIVE CAPITAL.—One curious phenomenon attending the remarkable changes that have taken place within the last half century in the conditions of production and distribution of wealth, has been the more rapid increase in all countries of high civilization of that portion of their national wealth represented by the so-called personal property than in that portion represented by the value of land. Thus, in Great Britain, at the commencement of the present century, the value of land was believed to represent about forty per cent of the aggregate wealth or property of the kingdom. At the present time it probably does

not represent more than twenty-five per cent of such aggregate. In the United States the increase in recent years of personal property has been so remarkable as to entitle it to be regarded as phenomenal; and it can not be doubted that in highly civilized and densely populated States, like New York, Massachusetts, Rhode Island, etc., the aggregate of property classed as "personal" is greater in actual value than the aggregate of "real" property. In the great American cities the value of personal property probably closely approximates the English proportion. A recent report of the Boston Business Association expresses an opinion that the value of the personal property of that city is three or four fold that of its realty! And yet the amount of personal property made available for tax assessments shows everywhere a remarkable decrease; and this, notwithstanding a great concurrent increase in population and in the assessed value of real estate. It may also be regarded almost an economic axiom, that universally the market value of the aggregate of land and that of the aggregate of other productive capital are equal; and for the reason that the market value of land is merely the reflection of the value of the productive capital placed upon it and its immediate vicinity. It would therefore seem to be certain that the decline in the valuations of personal property, above noted, is not real, but simply represents the failure and utter inefficiency of the existing laws which have been enacted with a view of assessing and collecting taxes upon such property.

The following are some of the most striking illustrations of the decline of tax valuations of personal property in recent years in the United States: Thus, in 1866, the valuation of the city of Cincinnati, Ohio, for purposes of taxation was, *realty* \$66,454,602, *personalty* \$67,218,101. In 1892—twenty-six years after—the tax valuation of the real estate of the city was \$144,708,810, while its personal property had decreased to \$44,735,670; or, in other words, while the personal property of Cincinnati returned for taxation in 1866 was greater than the returned amount of real estate, the amount returned in 1892 was only about a quarter as much as the real estate; and yet during this quarter of a century the city of Cincinnati nearly doubled its population, and undoubtedly increased its wealth in a far greater proportion. In the city of Boston the value of the realty returned for taxation in 1868 was \$287,635,800, and of *personalty* \$205,937,300. In 1890 the corresponding figures were, *realty* \$619,990,275, *personalty* \$202,051,525, a disproportionate gain of realty of \$417,938,750.

In the State of Massachusetts in 1862 *personalty* was assessed at \$309,000,000 to \$552,000,000 of real estate, or in the ratio of fifty-six per cent of the latter. In 1891 the *personalty* was \$556,-

000,000 to \$1,679,000,000 of real estate, or in the ratio of thirty-three and a third per cent. That is, the personalty of the State in twenty-nine years increased only \$247,000,000, while the real estate increased \$1,127,000,000, or nearly five times as much in the same time. "This simply means that more and more personal property, under the rigid tax system of Massachusetts, escapes taxation. The real estate can not have increased in value without an increase in personal wealth with which to increase the demand for it. Real estate does not make a demand for itself." In 1870 the personal property of the entire State of Massachusetts returned for taxation represented an average of \$345 *per capita*.

It will be noted that the above exhibits represent the lengthened experience of the two States which adhere most closely to the infinitesimal theory of taxation; have a system of most comprehensive and explicit laws, framed by officials and enacted by legislators who believe in their theory, and a system of arbitrary administration that finds no parallel, except in thoroughly despotic countries, and is wholly antagonistic to the principles of a free government.

The experience of other States, where, under substantially the same provision for the taxation of personal property, the administration is less rigorous, is also most instructive.

In Jersey City, N. J., the tax valuation in 1892 of realty was \$78,176,000, and of personalty \$6,539,750. In 1870 the valuation of realty in the city of Brooklyn, N. Y., was \$183,689,000, and of personalty \$17,559,980. In 1893 the corresponding valuations were \$486,497,000 realty, \$17,559,000 personalty; and of the latter only \$7,078,000 was assessed against individuals, the remainder being property of banks and corporations. Of the entire property of Brooklyn taken cognizance of by its tax officials in 1893, only 1.35 per cent of the whole was personalty proper.

In 1870 the entire value of the personalty of the city of New York, including bonds, jewels, pictures, furniture, bric-a-brac, etc., was put down by its assessors for taxation at \$281,142,696; in 1893 the corresponding valuation was \$370,936,000, of which less than half was personal estate proper, the remainder being various forms of corporate property, although it is reasonably certain that less than twenty men, residents of the city, held personal property in excess of this amount.

In 1870 the personal property of the entire State of New York returned for taxation represented an average of \$99.13 *per capita*. In 1893 this average had fallen to \$68.75 *per capita*. In Connecticut, in 1855, as before shown, State stocks, railroad, city, and other bonds, and money at interest constituted about ten per cent of the aggregate assessed valuation of property of the State. In 1885 the

corresponding proportion for taxation was three and three fourths per cent.

Similar illustrations drawn from the recent tax experiences of nearly every State in the Union might be indefinitely multiplied, and in the most western States of the Union, where the communities are mainly agricultural, the opinion of officials is also to the effect that personal property, as a rule, exceeds realty, and to a great extent escapes assessment and taxation.

Another curious and interesting feature of the situation is that in all those States where the most minute and thorough system of questioning with respect to the ownership of personal property prevails, investigation shows that, notwithstanding the acknowledged great increase in wealth in the form of personal property in recent years, the skill of its owners in concealing it has grown more rapidly; or, in other words, in every State in which a vigorous attempt has been made to reach and assess all the personal property of its citizens, a smaller percentage of such property is taxed to-day than was effected under operation of laws a quarter of a century ago.

RESULTS OF RECENT ADMINISTRATIVE EXPERIENCES.—A notice of some comparatively recent administrative experiences in attempting to successfully enforce taxation of personal property is especially pertinent at this point.

In 1879 California proposed a new Constitution. It was drafted in accordance with what was supposed to be the interest of the agricultural voters of the State, and was by them ratified, the merchants, commercial and financial interests being almost unanimously arrayed in opposition and voting against it. Under this Constitution and the laws made in pursuance of it, the results have been thus summarized: "Not only were bonds, money, and credits taxable, without any deduction on account of debts, except from credits, and then only such debts as were due to residents of the State of California, but holders of stock in corporations were avowedly and intentionally subjected to double taxation; first, upon the corporate property, and again upon the capital stock, which is merely their evidence of title to that property. It was supposed, alike by the friends and enemies of the new Constitution, that under its operation personal property of every description would be thoroughly reached, and at any rate that whatever was by any chance overlooked would be more than made up by double taxation upon that which was found. The actual result has been to falsify all the predictions of both the friends and enemies of the Constitution—for it has done no good, and very little harm, except in promoting fraud—for the reason that the capacity of the patriotic taxpayer to commit perjury and the susceptibility of assess-

ors to bribery have been altogether underestimated." Some of the results have been positively ludicrous.

"If the assessment returns are to be believed, in nine tenths of California there is not a pound of butter; in four fifths of the State the sheep do not produce any wool; fifty counties have quantities of beehives, but only four have any honey; personal property is vanishing from San Francisco; loans of money are becoming unknown in the rest of the State; bonds of cities and municipalities of all kinds are not held within the State to an amount equal to one sixth of the county bonds outstanding alone; and, finally, money has been smitten by a pestilence, two thirds of all that there was before the adoption of the Constitution having already taken to itself wings, and the remainder being evidently on the way. One of the great objects of the new Constitution was to tax railroad, telegraph, and telephone companies to the last cent of their value. The actual result has been that telegraph and telephone companies are now assessed for the cost of less than their bare poles, or about sixty-five dollars per mile. The railroad companies resisted taxation for one or two years, at the end of which, by a singularly simultaneous impulse of virtue, some thirty boards of supervisors directed their district attorneys rigorously to prosecute the railroad companies to the uttermost of the law. Thirty district attorneys forthwith hauled the railroad companies before the magistrates of justice. With equal promptness the thirty boards of supervisors met, and, without any consultation with each other, passed resolutions directing the district attorneys to compromise all suits at sixty per cent of the amount claimed; and the thirty district attorneys obeyed before the State officers could put in a protest."

It was anticipated that the new order of things would increase the burden of taxation on the city of San Francisco, and especially on personal property and money at interest. What actually happened is shown by the following figures: In 1880, before the new laws became operative, the city of San Francisco paid taxes on a valuation of \$68,586,000 of personal property not money, and on \$19,747,000 of money at interest or otherwise. In 1886, after the law had been operative for five years, it paid on a valuation of \$48,705,000 of personal property, a decline of one third, and \$6,188,000 of money, a decline of two thirds. In 1894, after the law had been in operation for fourteen years, it paid on a valuation of \$56,130,000 of personal property, a decline of \$12,454,000, and \$7,100,000 of money at interest, a decline of \$12,647,000.

It was naturally supposed that the new Constitution would have great influence in increasing the assessment of personal property in the form of tangible, visible merchandise, and of bonds and credits.

But the assessors of San Francisco found less of merchandise to tax in 1886 in that city than they did in 1880; and less in 1894 than they did in 1880, while the value of bonds returned by its citizens declined from \$2,311,000 in 1880 to \$449,000 in 1886. The total increase in the valuation of merchandise for bonds and credits for taxation in the fourteen years from 1875 to 1889 was less than one per cent.

The most recent, important, and incontrovertible record, however, of administrative experiences on this subject is to be found in the report of a tax commission authorized by the Legislature of Ohio, composed of four eminently qualified citizens—two Republicans and two Democrats—and presented to the Governor of that State in December, 1893. It is no exaggeration to say that, since the days of the French monarchy under Louis XVI, no report has been or could be made more discreditable to the people of any country claiming to be civilized, honest, and law-abiding.

The report first shows that Ohio has "the most efficient and minute scheme" of listing in duplicate "all classes of property"—dogs specially included—"which has been devised in any State." "Every citizen is bound under oath to make a complete return of his property," embracing all forms of personalty. "If he declines to make the oath required by law, a penalty of fifty per cent is added." This listing system in Ohio is characterized by the commission as like "the assessment list used in Germany in mediæval times (1531)," which it further asserts "has been abandoned everywhere in Europe." The statute provides that a designated official "may through the probate court call before him the citizen and examine him if he suspects that the return is not a complete one"; and in addition to all this the law empowers each county to contract with such persons—"tax inquisitors"—who may give information as to any personal property that has been "improperly withheld from the returns"; and who shall be "rewarded" to the extent of twenty per cent of the amount of tax "recovered through their efforts."

From a large amount of evidence collected by the commissioners and officially published by the State, the following selections illustrate the efficacy and workings of this system and its statutes:

For the year 1891 the gross amount of revenue collected in the whole State of Ohio through the operation of the tax inquisitorial law was about \$750,000, or about two per cent of the entire taxes of the State. For the nine years from 1885 to 1893 inclusive, during which time this act was operative in Hamilton County, which is mainly the great and rich city of Cincinnati, the whole amount of taxes paid by its citizens was about \$50,000,000, of which less than

\$400,000 accrued through the operation of this agency. It is probable, however, that through its moral influence the taxpayers were induced to make larger returns of personal property than they would otherwise do. On the other hand, the commission report as a general effect of the "tax inquisitor law" in city counties that when a man of large wealth is made to pay through its agency he leaves the State; but in the country counties, as the man of means is not able to sell his property and remove from the State, he is forced to remain and pay the tax.

Again, the laws of Ohio require that all moneys owned by its citizens shall be annually returned for taxation. For the whole State the tax commission reports that there was on deposit in the year 1892 to the credit of individuals in national, State, and private banks, and exclusive of moneys redeposited by one bank with others, at least \$190,000,000, "and probably a much larger amount." Of this \$190,000,000, there was returned in 1893 for taxation a little over \$38,000,000. In connection with this experience the commission calls attention to the following other extremely significant facts: "Of this estimate of \$190,000,000, about \$128,000,000 was deposited in the banks of the five counties containing the cities of Cincinnati, Toledo, Cleveland, Dayton, and Columbus. These same counties, however, returned for taxation only \$6,088,096, while the remainder of the State, having about \$70,000,000 in bank deposits, returned over \$32,000,000." In the spring of 1892 there were on deposit in the various banks (national, State, and savings) of the city of Cleveland about \$63,000,000. Of this money there was returned for taxation in that same year only \$1,800,593; and about half of this sum was derived from the townships outside of the city."

The final conclusions of the commission were that "while in the country counties" (of Ohio), "where the assessor is personally acquainted with the circumstances of the taxpayer, and knows his wealth, the taxation of intangible property is perhaps feasible, it is in the city counties an utter failure. The general property tax has become in the city counties" (of the State), "to a very considerable extent, a tax upon tangible property only; and that no appreciable part of the intangible property existing in the city counties is reached by our method of taxation."

The net result of all the comparisons made by the Ohio commissioners between city and farming districts finally goes to prove that *the tax upon personal property makes farmers pay from four dollars to seven dollars where it makes the residents of large cities pay one dollar.*

Speaking generally of the effect of this Ohio scheme of taxation the commission further says:

"The system as it is actually administered results in debauching the moral sense. It is a school of perjury. It sends large amounts of property into hiding. It drives capital in large quantities from the State. Worst of all, it imposes unjust burdens upon various classes in the community: upon the farmer in the country, all of whose property is taxed because it is tangible; upon the man who is scrupulously honest; and upon the guardian, executor, and trustee, whose accounts are matters of public record. These burdens are unjust because by the system as administered these people pay the taxes which should be paid by their neighbors." And the commissioners finally add that "these conclusions are in accord with all current authorities on the subject."

That this claim of accordance on the part of the Ohio commissioners is fully warranted, attention is next asked to the conclusions of other State commissions which within a comparatively recent period have also officially investigated and reported upon this subject. Thus, a tax commission of New Hampshire in 1876, after recognizing the inefficiency of the existing laws for the taxation of personal property and "their corrupting and demoralizing influences," "frankly admit that they are unable to frame any law to which a free people would submit, or should be asked to submit, that will bring this class of property under actual assessment more effectually than it now is." An Illinois commission in 1886 asserted that the existing system "is debauching to the conscience and subversive of the public morals—a school for perjury, promoted by law." A Connecticut commission in 1887 reported that "the results of an investigation of nearly three years into the workings of our tax system have brought us to the conclusion that all items of intangible property ought to be struck out of the list. As the law stands it may be a burden upon the conscience of many, but it is a burden on the property of the few, not because there are few who ought to pay, but because there are few who can be made to pay." A West Virginia commission in 1884 asserted that "the payment of the tax on personalty" (in the State) "is almost as voluntary, and is considered pretty much in the same light, as donations to the neighboring church or a Sunday school."

In Massachusetts, where the law admits no offset of debts against visible and tangible property, and is regarded as complete, and where its execution is acknowledged to be most arbitrary and inquisitorial—some towns publishing each year every known item of each man's personal property, even down to the family pig and a string of sleigh bells—the most intelligent officials admit that their system is a comparative failure; and almost a complete failure as to reaching evidences of indebtedness, which, as before shown, constitute in

modern times so large a part of the personal property of every civilized community.

In the State of New York, where the letter of the tax laws in respect to the subjects of taxation is nearly the same as in Massachusetts and Ohio, but the administration less stringent, and where the aggregate of personal property nearly or fully equals in value the aggregate of real property, the proportion of the former returned for taxation is not in excess of one fifth of the total assessed valuation; while in the great city of New York, with a population of over a million, not one per cent of her citizens stand upon the books of the assessors as possessing any personal property subject to taxation other than shares in banking institutions.

In Wisconsin the State appears to have drifted into the same condition of things as in New York, and the attempt to tax personal property has been practically abandoned, except in the small villages and rural districts. In Georgia, which is reported to be well served by its taxing officials, its comptroller asserts that in respect to the mere article of merchandise which can be seen and handled, not fifty per cent is returned for taxation, and that in the city of Savannah in 1886 not ten watches were subjected to taxation.

To complete this record of experience it is desirable to add that there is not a single economist or financier of note, either in the United States or Europe, who upholds the "infinitesimal" or "general property" tax as a desirable or essential feature of any fiscal system, its characterization by M. Leroy-Beaulieu, the celebrated French economist, being that "a cruder instrumentality of taxation has rarely been devised."

Again, in every country on the globe where a direct tax on personal property in the hands of individuals has been laid, the system has exhibited the same features of badness. No experience in any country has suggested any practical improvements of it. It has never been improved; it has never grown better; it has always, under all circumstances, exhibited a tendency to grow worse. It is a fact creditable to the superior intelligence of other lands that it no longer is found in any civilized country on the globe, the United States alone excepted; and in this country it is no longer found in Pennsylvania, New Jersey, and perhaps some other States.

Prof. E. A. R. Seligman, of Columbia University, who has written much on this subject, sums up the result of his investigations in the following language: "It will be no exaggeration to say that the general property tax in the United States is a dismal failure. Every country also, with the exception of Holland and the States of the Federal Union, has abandoned this system of tax as something wholly impractical. In recent years in both England and France

the necessity of raising increased revenues has drawn especial attention to the subject of local taxation; but in neither of these two countries has any prominent speaker or writer advocated the direct taxation of personal property, or even alluded to the subject, except to scout the very idea of such a proposition.*

And yet, notwithstanding this record of disastrous and discreditable experience, and the opposition to the almost unanimous judgment of all whose investigations warrant the expression of opinion, the strength of popular prejudice in the United States in favor of the infinitesimal system of taxation is so great as to make the substitution of any better system a matter of very great difficulty, and perhaps a present impossibility. "Although all Europe, as already pointed out, has tried and discarded taxation of personal property, our own people have grown up under the opposite system. Every State tries to tax it. No American has any personal experience of a system which does not pretend to tax it. The proposition to dispense with such taxation, therefore, strikes every American as an experiment. Few Americans know or care anything about the experience of other nations."

There is, however, at the present time, some gratifying evidence of a change in popular sentiment in favor of radical tax reforms. Thus, in October, 1897, the grand jury of the county of New York made a presentment on the subject of taxation under the following circumstances: A complaint was made against the tax officials, charging undervaluations of property, and therefore perjury, but the grand jury finds in effect that the State laws are of such a character that assessors are almost inevitably led into blunders, and it recommends a general revision of the tax laws imposing upon the State the duty of assessing personal property, so that local expenditure may be paid by real-estate taxes alone, and the "question of continuing or abolishing personal taxes" be "fought out on State lines."

A special tax commission, appointed by the Governor of Massachusetts, and composed of men of wide financial experience and business ability, after careful study of this subject, reported in October, 1897, in favor of the entire exemption of personal property

* Holland, by reason of her immense national debt, the largest, comparatively, of any country, has been obliged to maintain a most rigorous and extensive system of taxation in order to raise revenue sufficient to the wants and requirements of the state. But it has been prominently brought out, in recent years, that the decadence of Holland dates almost from the hour when taxes were imposed on manufactories, commerce, fishing industry, and moneyed capital. Business went elsewhere, and with the decline of business the ability to pay taxes diminished, and the burden of taxation augmented. (See *Journal des Economistes*, November, 1871; also *Principles of Political Economy*, J. R. McCulloch, pp. 470, 471.)

and the substitution of other agencies (to be hereafter noticed) for the collection of revenue.

A fact of historical interest which ought not to be overlooked in this connection is that whenever a system of infinitesimal taxation (or a general property tax) has been projected, its authors have been led, as it were, by instinct to the conclusion that its execution, with any degree of effectiveness, must depend upon the employment of extraordinary and arbitrary measures. Thus, the old Romans, who first notably established the taxation of personal property at the period of the decadence of the empire, and who were not troubled with any restrictions of a constitutional character, or any very nice notions about personal liberty or general morality, clearly perceived this, and accordingly invested their tax officials with the power of administering torture as a means of compelling information (answering questions) and enforcing payment; and that the tax officials were not backward in using the power with which they were invested is proved by a variety of evidence.

Thus, Zosimus, who wrote in the fifth century A. D., states that the period of the tax collection upon general industry "was announced by the tears and terrors of the citizens, who were often compelled by the impending scourge" to meet their obligations; and Gibbon, in treating of this feature of Roman history, in a measure justifies the proceeding in the following language: "The secret wealth of commerce and the precarious profits of art and labor are susceptible only of a discretionary valuation; and as the person of the trader supplies the want of a visible and permanent security, the payment of the imposition, which, in the case of a land tax, may be obtained by the seizure of property, can rarely be extorted by any other means than those of corporal punishment."

And it is also especially worthy to note that in every instance in which attempts have been made of late in the United States to remedy the recognized imperfections and inequalities of existing systems of local taxation, the persons intrusted with the duty, possibly without knowing, and probably without caring, what were the experience and custom of the old Romans, have been led by their instincts and intuitions to go as far in the torture direction for the obtaining of taxes on personal property as the conditions of our modern civilization and the state of public opinion would allow.

The most curious and confirmatory evidence of this is to be found in a method of procedure adopted in the city of Boston, Massachusetts—a method which has no parallel except in the records of the middle ages and of the Inquisition, and constitutes in itself a satire upon any claim to the enjoyment of a wholly free and enlightened government. For failing to obtain satisfactory information

about the private affairs of any individual the chief assessors and their subordinates in that city, to the number of some fifty, meet in secret session in a large upper chamber set aside for the purpose, and appropriately termed the "dooming chamber," when the citizen in question, without being present either by counsel or in person, is arbitrarily doomed to the payment of any sum which a majority of those present may think proper, and from which "dooming" there can be no appeal.

The following record of the actual working of this system may be thus illustrated: During the year 1889 the whole amount of taxable personal property which the assessors of Boston were able to discover, exclusive of bank stock, was \$39,000,000, of which amount \$14,570,000, or thirty-seven and a half per cent, was returned as visible, and \$27,650,000 as invisible. Being dissatisfied with this result, which was all that was justified by any facts which the assessors could state, they proceeded to multiply it four and a half times by a mere guess. In their "dooming" chamber they guessed that personal property, other than bank stock, ought to be valued at \$186,000,000; and the citizens of Boston were compelled to pay taxes upon that amount. Could anything be more monstrous or absurd than a system of taxation which, even when administered by phenomenally honest and competent men, produces such results?

THE USE AND VALUE OF OATHS AS AN ADJUNCT OF TAXATION.—Consideration is properly asked in this connection to the use and value of oaths, an increase in the number and stringency of which is often regarded as essential to effective and equal taxation. It is the all but unanimous opinion of officials who of late have had extensive experience in the administration of both the national and State revenue laws that oaths as a matter of restraint, or as a guarantee of truth in respect to official statements, have in a great measure ceased to be effectual; or, in other words, that perjury, direct or constructive, has become so common as to almost cease to occasion notice. In fact, there has come to be a feeling in the community that an oath in respect to matters in which the Government is a party is a mere matter of form, of mechanical procedure, and that its violation, especially with a mental reservation, and when the interest of other individuals is not specifically affected, does not in itself constitute a crime. The fact that the assessors of almost every State every year make oath that they have valued all property at its actual value, when they know they have not, constitutes one proof of the truth of this assertion. The everyday entry of goods at the customhouse at undervaluation constitutes another; the enormous frauds committed in recent years under the internal revenue laws of the United States, which in the case of distilled spirits en-

tailed a loss in a single year of over \$130,000,000, and in which the taking of false oaths was at every step an essential feature, constitutes a third; while of individual examples, which every assessor of experience can detail, the record would be almost interminable.

During the past few years the low tone of commercial morality in the United States has been a fact generally recognized and much commented upon; but it has not, that we are aware, been made a subject of inquiry by those to whom the guardianship of public morals is particularly intrusted. How far the existing system of laws relating to taxation—national and State—are justly chargeable with the results to which reference has been made, or how much in the division of responsibility is to be set down to the account of those who violate the law, and how much to those who, forewarned of the weakness of human nature, deliberately make laws which especially lead men into temptation, are yet unsettled questions.

A point of great interest and importance in this connection, though often overlooked, is that even if all the States of the Federal Union should entirely exempt personal property within their territory and jurisdiction from taxation, it would nevertheless, owing to the dual nature of the Government of the United States, be subject to a large measure of heavy and disproportionate taxation. Thus, the expenditure of the Federal Government, which represents taxation, was in 1896, including the cost of revenue collection, in excess of \$445,000,000, not one cent of which was derived from taxes on real estate.* The aggregate of annual taxation by States, counties, cities, municipalities, and the District of Columbia for the same year is estimated by reputable authorities to have been about \$400,000,000, of which at least one fifth was assessed or was collected from personal property. If real estate paid all the State taxes, personal property therefore would still be paying all the United States Government taxes, or a large excess of its equitable share of any or all national taxation. A claim that any personal property owner is justified in protecting himself against such extortion in any and every legal way has much, therefore, to be said in its favor. When such protection can not be effected legally, he has only to leave the State for others that are not extortionate oppressors of capital. But who can not perceive on reflection that personal property (capital) must be largely used by its owners and at fair rates at their residence; and that the home of such capital will show the benefit in increased local business, increased population, and increased value of real

* Real estate pays no Federal Government tax.

estate by its use? Why, then, so much overrighteous talk of personal property owners dodging taxation?

Logical and ingenious as have been the arguments in opposition to the legal exemption of personal property from taxation; the citation and consideration of the undisputed experience of all countries, people, and ages are all that is necessary to refute and disprove them. There was a time when nearly all men believed and taught that the world was flat, and when the few who lisped to the contrary exposed themselves to a charge of religious heresy and punishment. But a comparatively short navigation experience effectually put an end to all controversy on this subject; and it is doubtless only a question of time when personal property will be exempt from governmental taxation, because no system has ever been devised, or is likely to be, which will enable a state to tax it with any approach to uniformity and equity.

ORIGIN AND HISTORY OF THE GENERAL PROPERTY TAX.—The idea that in order to tax equitably it is necessary to assess everything capable of resulting in the obtaining of revenue is not original with the American people. Its inception dates back to the dawn of civilization, and its development may be regarded as in the nature of an economic evolution. In the incipient stages of society, as already pointed out, property consisted exclusively of things tangible and visible—lands, buildings, cattle, slaves, agricultural products, household effects, and implements—and what was exacted by rulers or chiefs of their subjects was arbitrary proportions of such kinds of property or of personal service, and was not in any proper sense taxation, but tribute. For thousands of years there were no credits or material evidences of indebtedness, as there are none at the present time among barbarians or half-civilized people; for a knowledge of letters, of the art of writing, and a somewhat durable and portable material to write upon were essential prerequisites for their existence, the earliest evidence of the recognition of anything like a mortgage being the inscriptions on certain clay tablets excavated from the ruins of the ancient cities of Babylon and Assyria, which were evidently the highest results of long and slowly developing civilization. In fact, in the early stages of society there was no important form of capital other than landed property and the instrumentalities, including slaves, for its cultivation, and so far as the system for obtaining revenue for the rulers or state merited the name of taxation, it was practically a "land" tax.

As civilization advanced, slavery gradually broke down; trade or traffic between individuals or adjacent communities extended and became commerce; free labor appeared; capital developed and multiplied the forms of visible, tangible property. Then the system

of obtaining revenue began to have the characteristics of a general property tax; and as the coincidence of great value with small bulk in some forms of tangible, visible property favored concealment, some methods of obtaining revenue from property other than mere inspection became necessary, and were obtained by the Romans in the latter days of their empire by endowing their assessors and taxgatherers (as before shown) with the power to administer torture to unwilling taxpayers, a method that was followed and perpetuated until within a very recent period by the rulers of most Asiatic countries; and in later days, when credits came into existence and extensive use, and titles to property and evidences of indebtedness were regarded as property, although intangible and invisible, a method for discovering and assessing the same, as approximate to actual torture as a higher civilization would sanction, was everywhere adopted.

And how such methods continue to exist and their practice be regarded with favor in states and communities claiming to be in the highest degree civilized and enlightened, finds proof and illustration in the following circumstance. In 1874 the Legislature of Massachusetts created a commission of three persons to inquire into the expediency of amending the laws of that State in respect to taxation, and placed at its head the chairman of the Board of Assessors of the city of Boston, a gentleman long identified with, if not the originator of, the idea of making an arbitrary, irresponsible "dooming chamber" an essential feature of tax administration. At the outset this commission was evidently impressed with the necessity of vindicating the "infinitesimal" or "general property" tax system, then and at the present time especially favored and fully exemplified in their State. And they set about it in the following manner: with the Declaration of Independence before them, maintaining it to be in the nature of a self-evident truth that "all men are endowed by their Creator with certain inalienable rights," and "that among these are life, liberty, and the pursuit of happiness," the commission gravely announced that "*the individual person*" (in Massachusetts) "*has no individual rights except that to his own righteousness,*" thus laying a sure foundation in justification for a recurrence in Massachusetts to the torture tax system of the ancient Romans if its tax administrators should consider it expedient.

After the dissolution of the Roman Empire and the subsequent reconstruction, as it were, of government and society in Europe during the early feudal period, and when land was practically the only form of wealth, the payments exacted for the support of the governing powers—kings, barons, knights, etc.—were essentially and almost exclusively in the nature of land taxes; and the terms

"*danegeld*," a charge on lands at so much per hide, or an area of about one hundred acres; "*scutage*," a charge on tenants in lieu of military service; "*carriage*," a charge on "plow lands"; "*talliage*" (from the French *tailler*, to cut off), a charge on the tenants of royal manors, and the like were designations of the different forms of such assessments at different periods. As civilization advanced and was accompanied, as at a more primitive period, with an increase in the forms of personal property, a combination of taxes on land and movables, or a general property tax system, developed and was adopted by all the nations of western Europe with all the despotic adjuncts which seemed necessary to make its enforcement successful. The ultimate result of such a system was what might have been anticipated. From a very early period it occasioned great popular dissatisfaction. In Milan, Italy, as early as 1208, it was enforced with such severity "that the assessment book was known as the *libra del dolore*." In Florence it became so honeycombed with abuses and the load of taxation fell with such crushing force on the small owners of property that imminent popular revolution and disorder compelled its essential modification. As wealth increased, evasions of the tax increased in a greater proportion in every community, leaving the burden of the system, as now in the United States, on that class of the population—mainly the agricultural—that are least able to bear it. Sir Robert Cecil stated in 1592 that there were not five men in London assessed on their goods at two hundred pounds (one thousand dollars); and Sir Walter Raleigh stated in 1601 that "the poor man" (in England) "pays as much as the rich." In Florence in 1495 only fifty-two persons paid the tax on trade capital, although the amount of such capital must have been immense. Marshal Vauban, of France, who wrote on taxation about 1700, stated that the *taille personnelle* was assessed only on the poorest classes. The result has been that as the difficulty of assessing visible personal property and the impossibility of reaching invisible and intangible personalty became apparent, the tax was gradually modified, and finally abolished in all European countries, except possibly Switzerland and Holland, where its nature has very little of its original and typical character. One of the first acts of the French National Assembly in 1789 was to abolish it entirely. A provision for taxing personal property under a nominal land tax continued to exist on the statute book until 1833, when, through constant exemptions and systematic evasions, the annual revenue accruing from the same had run down to the sum of eight hundred and twenty-three pounds (four thousand one hundred and fifteen dollars). It is also interesting to note that the people of Europe have been so long exempted from a general property tax that their

leading writers on economic or fiscal subjects rarely discuss it or even seem to have any knowledge of its characteristics or historical experience.*

The United States is the only civilized country that gives no heed to the world's uniform record of experience, and thinks it desirable to tax both property itself and its shadow.

PACIFIC COAST GULLS.

By HARRY L. GRAHAM.

TO my right, to my left, overhead, everywhere, gulls, gulls, gulls! Big gray fellows standing on the wharf edge; white chaps, with black heads, flapping their long, black-tipped wings and making noises that could be likened only to creaky wheelbarrows! Such was my experience one day as I walked out on the pier at San Diego, California, to take the ferryboat across the bay to the charming Coronado peninsula.

Along the wharves and on the muddy flats left bare by the receding tide, the gulls were almost as plentiful and quite as tame as the English sparrows are on the North River piers at New York city. A half dozen sat on the bowsprit of a little coaster that was loading with freight and a few passengers for Los Angeles. Out in the harbor the United States revenue cutter Monterey lay at anchor, ready for coaling up on the morrow. On her spars and flying all about her were scores of gulls, eagerly watching for some scraps of food that might be thrown from the galley.

As our boat steamed across toward the opposite shore we were accompanied by quite an escort of these interesting birds, beautiful to look at in their almost entirely white coats. Watching the flight of one bird that came close alongside the boat, I was impressed with its easy, graceful movements; every time the long, strong wings made a stroke the bird's body seemed to rise as though breasting an invisible wave, the gull all the while turning its head from side to side as if looking for something. I thought of that strange belief, prevalent in certain localities, that gulls are the disembodied spirits of those who have lost friend or relative by drowning at sea. This superstition has been versified by Mr. A. J. Burdick, and the poem is worth quoting in its entirety:

* To those desirous of a fuller record of the historical experience of the general property tax than has been here given, reference is made to an exceedingly interesting and valuable essay on the subject by Prof. E. R. A. Seligman, of Columbia University.

" TO A GULL.

" Soul of bereaved one, troubled and tossed,
 Searching the sea for the one that was lost;
 Skimming the air or riding the wave,
 Seeking forever that precious one's grave;
 Bird of the sea, is it true, is it true,
 That the soul of some mourning one lives within you ?

" Whom art thou seeking, some brother or son
 Who sank to his rest ere his voyage was done ?
 Or was it a husband, or lover so brave
 Who found an unmarked and untended grave ?
 Bird of the sea, is it true, is it true,
 That the sea holds the one who is dearest to you ?

" Bird of the sea, when the dismal winds wail,
 And the breast of the ocean is swept by the gale,
 When the demons of storm in their fierce anger rave,
 And you sink 'neath their wrath to a watery grave,
 Bird of the sea, is it true, is it true,
 That the loved and the lost you find waiting for you ?"

To "those who go down to the sea in ships" it is most interesting to watch the antics of the flock of gulls that follows a vessel, hour



HERRING GULL (*Larus argentatus*).

after hour, on the watch for scraps of food that may be thrown into the sea. The birds are sharp-eyed and wise, and not to be deceived by anything short of real crackers. A traveler once tried to cheat the gulls by tossing out bits of orange-peel and cardboard, but the birds paid no attention whatever until a cracker was thrown to them, when immediately a wild rush was made and the cracker seized before it touched

the water.

It has been thought by some that the gulls which follow a ship all day return to the nearest land at night, and another flock appears the next morning. Only recently an experiment was tried that dis-

proves this theory, and I take the liberty of quoting in part from the account given in the *Scientific American*:

"On a late trip of one of the steamers plying between Portland and San Francisco the question came up among the passengers as to



KITTIWAKES.

whether the gulls which appeared around the ship each morning were the same birds as had been with the ship on the day previous. To test the matter, a line and fishhook were procured, and with a bait of salt pork the fishing for a sea gull was commenced.

"The first cast of the line was successful, a big gray bird swooping down on the bait. He was hauled aboard and found to be uninjured, the hook having caught in one of the glands of the beak, from which it was readily loosened. After detaching the hook a strip of red flannel was brought and carefully tied around the gull's left leg by one of the seamen of the steamer, the bird being then turned loose. Circling for a moment in the air, the gull started toward the distant blue streak which denoted the coast line, and it was generally allowed that each day brought a new contingent of gulls to follow the steamer and pick up the waste scraps from the table; but on coming on deck after breakfast the next morning there was the flannel-bedecked gull to be seen, the most clamorous of all the birds. To test the gull's reasoning power, if it had any, the same line and bait was drifted astern, the gull caught the day before being one of the first to strike for it."

During my stay at Coronado Beach I remember one delightful afternoon spent watching the birds as I lay stretched at full

length on the warm sands. Far out over the waves I saw, more than once—

“A flock of sea birds darken into specks ;
Then whiten as they wheel with sunlit wings,
Winking and wavering against the sky.”

At the water's edge a score or more of long-billed curlews ran about, picking up crabs and shellfish cast up by the tide. A few gulls mingled with the curlews and watched for opportunities to steal the dainties they snatched from the waves. Some distance out from shore three great brown pelicans flew back and forth—

“On solemn wings that wave but seldomwhile.”

They were fishing, and at intervals one would dive with a terrific splash into the ocean after its finny prey. Through my field glass I could see the huge bird come to the surface, and with great effort mount into the air, beset on either side by those “pirates of the deep,” the skua gulls, whose principal occupation is stealing from pelicans and gulls the prey they capture. Ornithologically speaking, these skuas are not true gulls, though in looks and habits there is a family resemblance. Some one has aptly called them “the hawks of the sea.” They are fierce, overbearing robbers, like some of the land birds of prey.

One day on the beach, a short distance above the Coronado Hotel, I watched some Chinese fishermen casting their large net into the ocean, in the same primitive manner, doubtless, as their ancestors had done for centuries. It was not the Chinamen who particularly attracted my attention, but rather a large flock of gulls that suddenly assembled as soon as the fishermen began to haul in the net. The birds evidently knew what was coming and circled about low over our heads. I had joined the fishers and was helping to pull on the rope. At last we dragged the seine high and dry on the beach, and found a goodly number of fish in the mass of seaweed—flounders and perch, as well as a lot of “shiners” and other fish too small to be marketable. The “small fry” were tossed oceanward, but were eagerly seized upon, almost before they reached the water, by the hungry gulls. When the men had finished the work of sorting out the big fish and moved away from the seaweed pile, which still contained dozens of little fish, the twoscore impatient gulls descended with loud cries of joy, and in less time than it takes to tell it every “shiner” had disappeared.

Gulls nest in colonies, generally on the ground along sandy beaches; also on the rocky ledges by the ocean. Large numbers nest on the Santa Catalina Islands and other rocky islands off the coast of California. Their eggs are gathered and sold as food in the

markets of San Francisco. I remember how horrified I was when I first heard this. It is to be hoped that such practices may cease, for if persisted in year after year the gulls and other sea birds will soon be as scarce as are terns on the coast of New Jersey and herons and pelicans on the Florida islands.

The most numerous of the gulls along the Pacific coast was the western gull (*Larus occidentalis*), a pure white bird with a slaty mantle. The young of this species have a dusty gray plumage. I saw many Heermann's gulls (*Larus heermanni*) at San Diego—slaty, blackish birds with a pure white mantle and smaller than the western gull. The young are of a pure slate color. A number of other



WESTERN GULLS.

*Larus occidentalis.**Larus californicus.*

species were seen frequently along the coast; the glaucous-wing gull (*Larus glaucus*), a large white bird with pale pearly mantle; the ring-billed gull (*L. delawarensis*), smaller, white, with pale mantle and black tips to its wings; the California gull (*L. californicus*), almost the size of the western gull, with a paler mantle.

When one thinks of a gull, it is always in connection with the seacoast, but it does not follow that you can only study the gulls beside the ocean. The American herring gull (*Larus smithsonianus*), an interesting member of the family, is frequently found hundreds of miles inland. It is a most useful bird to the farmers in Utah. I saw large flocks in the fields near Salt Lake City. They will follow the plow, just as the robins and blackbirds do in the

East, picking up great numbers of injurious insects. I am glad to say that the people of Utah appreciate the practical value of these birds, and stringent laws have been passed for their protection.

To the ordinary observer a gull would seem to be of little service to mankind, and to be looked upon only as an æsthetic addition to a marine landscape; this is not the gull's only use, as I have just proved. The gull, as well as every other bird, has a place to fill in the economy of Nature, and, as we learn more and more of the good work the birds are constantly doing for us, we will, it is to be hoped, afford them the protection they deserve.

OUR LIQUOR LAWS AS SEEN BY THE COMMITTEE OF FIFTY.

By FREDERIK A. FERNALD.

IN 1893 a group of fifteen gentlemen who had been conducting various sociological studies together formed, by adding to their number, the Committee of Fifty to investigate the liquor problem. Subcommittees on the physiological, the legislative, the economic, and the ethical aspects of the problem were appointed in the autumn of that year. The subcommittee on legislative aspects, consisting of President Charles W. Eliot, President Seth Low, and James C. Carter, Esq., engaged Dr. Frederic H. Wines, of Springfield, Ill., well known for his census reports and other investigations on the liquor question, and Mr. John Koren, of Boston, Mass., to examine the working of several typical State liquor laws. The facts obtained by Messrs. Wines and Koren constitute the first report of the subcommittee, which has been published under the authority of the whole Committee of Fifty.* Mr. Koren investigated the operation of the liquor laws of Maine, Massachusetts, Pennsylvania, and South Carolina, and Dr. Wines made like investigations in Missouri, Ohio, Iowa, and Indiana.

Much light is thrown upon the question, Does prohibition prohibit? by the conditions found to exist in Maine and Iowa. Maine has been under prohibition for nearly half a century—since 1851, with the exception of the two years from 1856 to 1858. That the famous "Maine law" has never been adequate to its purpose is shown, as the committee's agent points out, by the constant efforts

* The Liquor Problem in its Legislative Aspects. By Frederic H. Wines and John Koren. An Investigation made under the Direction of Charles W. Eliot, Seth Low, and James C. Carter, Subcommittee of the Committee of Fifty to investigate the Liquor Problem. Boston: Houghton, Mifflin & Co. Pp. 342. Price, \$1.25.

to strengthen it—nearly fifty amendments having been enacted since 1858. The law provides for an agent in each city or town who shall sell liquor for medicinal and mechanical purposes, but he by no means has a monopoly of the business.

According to the committee's report, liquor may be obtained in Portland from ordinary bars under police protection, kitchen bars, pocket peddlers, hotel bars, apothecary shops, bottling establishments, express companies, clubs, and the city liquor agency. The ordinary bars have little on the outside to betray their nature, but access is easy. "In the score or so of saloons of this class visited by the writer," says Mr. Koren, "from six to twenty persons were found who were there to drink, most of them young men, some of them boys between twelve and sixteen years of age. Occasionally small girls would come in to have 'growlers' filled. Sometimes older girls appeared, to drink and to talk with the men. The customers lounged about, smoking and drinking, with an apparent sense of freedom and security."

Mr. Koren estimated the number of kitchen bars in the city at the time of his investigation at about eighty. They are found in the poorer quarters, and rely more on concealment than on protection. They do most business on Saturday evenings and Sundays, and sell little but distilled liquor. The drinking at these bars is especially productive of intoxication, both because of the quality of the liquor sold and of the opportunity of uninterrupted indulgence.

"The pocket peddlers multiply with amazing rapidity during a period of strict enforcement, and most of them disappear as suddenly in 'wet times.' At the time of the present investigation not a few were found on the wharves and along the water front after dark, especially on Sundays. They supply 'split' at the rate of thirty cents a pint for the cheapest grade. Boys of fifteen and upward were found as venders of 'split.' The pocket peddler secures many victims on incoming fishing vessels and coasting schooners, which he boards at the first opportunity." "Split," Mr. Koren explains, consists of the cheapest kind of alcohol—sometimes wood alcohol—mixed with water, with a dash of rum for flavor, and some coloring matter. It produces a violent and dangerous form of intoxication.

At least five of the principal hotels sell liquor at bars. Protection costs them in the neighborhood of one hundred dollars a month, and they are occasionally raided. Beer is sold in large quantities at certain oyster houses.

From the number of the drug stores in Portland, one to each eight hundred inhabitants, and the location of many of them, it is evident that they can not all exist for the sale of drugs. When this in-

vestigation was made all but two or three had paid the United States special tax, which is *prima facie* evidence of violation of the liquor law. Druggists can not legally sell liquor for medicinal purposes, as this is the purpose for which the city agency exists. Not less than twenty of the forty-five drug stores in Portland are merely dram-shops in disguise.

Much of the family trade is supplied by wholesale dealers and by bottlers of mineral waters, and a number of express companies are ready to place orders for their customers in Boston and other cities, while some of the local expresses fill orders for liquors from their own well-supplied storage rooms.

Of the one place in the city where liquor is legitimately sold, Mr. Koren says: "On the occasion of the writer's first visit to the Portland liquor agency he was greeted with these words by one of the attendants: 'This is nothing but a legalized rum shop—that's all.' The statistics abundantly vindicate this assertion. It was explained that certain formalities were observed. Thus the name and address of each purchaser are recorded. 'Of course,' the informant went on, 'there are some we don't sell to and won't sell to (for instance, intoxicated persons and habitual drunkards), but if a respectable person comes in we don't ask questions.'"

The inquiries of the committee's agent were not confined to cities. Farmington, the county seat of Franklin County, sixty miles back from the seacoast, was spoken of by well-informed prohibitionists as a place where the law worked under the most favorable conditions. The town contains four villages and had three thousand two hundred and seven inhabitants in 1890, of whom only one hundred and seven were of foreign birth. Yet here liquor selling is far from being unknown. "Five United States special liquor taxes were paid for by residents in 1894. At two of the hotels both malt and distilled liquors are supplied to guests in their rooms, and not infrequently to others who drop in; but there are no bars. At one of the three drug stores, at least, liquor can be bought by any trusted customer. Furthermore, it is said by old residents that illicit sales are carried on intermittently at from one to three other places, but their identity is not easily revealed. An official, whose duty it is to enforce prohibition, is quoted as saying that 'from one to six packages of liquor arrive by express every day.'"

The report contains a review of the working of prohibition throughout the State by counties. Every city in Maine, except Auburn, has its United States licenses, and in no manufacturing town with a large number of French-Canadian operatives has the prohibitory law ever been strictly enforced. The tipplers of Auburn find prohibition endurable, for a short bridge connects their city

with Lewiston, where, an official is said to have declared, "One might as well try to turn back the current of the Androscoggin River as to stop rum-selling." The existence of summer resorts in some counties prevents a rigid enforcement of the law.

Massachusetts has had since 1881 a local-option law which provides for the granting of licenses only in cities and towns voting at the annual election or town meeting to authorize their issue. Places voting "No" may grant druggists' medicinal licenses. Two communities in this State were chosen for study: Boston, the chief city and center of the liquor trade, and North Adams, in the western part of the State, one of the smaller communities under license. Various supplementary acts have been passed since 1881. License fees have been raised, so that a license to sell all kinds of liquor to be drunk on the premises now costs one thousand dollars. The number of saloons has been limited to one for each five hundred inhabitants in Boston and one for each thousand in other places.

Mr. Koren reports that "open and flagrant violations of the liquor laws by licensed dealers are no longer of frequent occurrence. This is the testimony not only of the police but of private organizations directly interested in the question. The licensees realize better than before the nature of their privileges, and know that failure to observe the conditions imposed is likely to result disastrously. Sunday sales by saloons are practically unknown. Innholders may be found, however, who resort to peculiar methods of registering guests in order to sell liquor after hours under a guise of legality. Those who are bolder are pretty sure of punishment when found out. Few liquor shops would now dare to sell to minors where their minority is obvious. Sales to intoxicated persons occur commonly, as a matter of course; and any one can obtain, without the slightest difficulty, enough drink to produce intoxication. On the other hand, numerous dealers persistently refuse persons visibly under the influence of liquor." Illicit selling is confined within steadily narrowing limits. There are still some kitchen bars in the poorer sections of the city, whose best customers are the persons who come in from the surrounding no-license towns on Saturday evenings and Sundays for the avowed purpose of obtaining drink.

The population of North Adams contains a large element of factory hands, nearly all of whom are of foreign birth or extraction. The saloons are confined within a small section where they are under close supervision. "The general provisions of the law," Mr. Koren reports, "such as those against maintaining screens and selling after hours, are well observed. Sunday sales by licensed dealers even in hotels are practically unknown. The revocation of licenses for this cause has had a wholesome effect. A system of posting intem-

perate persons in saloons is in vogue, and admirable results are claimed for it."

As to the rest of the State, Mr. Koren says: "That the sale of liquor is as well regulated in all the other large cities and towns of Massachusetts as in Boston and North Adams is much to be doubted. In most of the license cities the bane of the influence of the liquor element in local politics is strongly felt; as a result, enforcement is lax and defiance of express provisions of the law common." We are not told whether or not liquor is sold in places where no licenses are granted, but Massachusetts probably does not differ much from Maine in that respect. The largest cities and towns that usually vote no license year after year are circled around Boston, "where a no-license vote removes the drinker a short and not seriously inconvenient distance from the base of supplies."

Pennsylvania has its "Brooks law," which went into effect in 1888. It is a high-license measure and embodies various restrictions. Much improvement in the character of the liquor trade has been secured under it in Philadelphia, chiefly through the efforts of the Law and Order Society of that city. Licenses are granted by the Court of Quarter Sessions in each county. The work of the license court in Philadelphia is highly praised. Owing to the connection which the liquor interest maintains with politics the full intent of the Brooks law is not carried out. Every application for a license has to be indorsed by twelve reputable electors of the ward, borough, or township in which the saloon is to be opened. In Philadelphia, school directors, members of city councils, police magistrates, clerks of the Courts of Quarter Sessions, State senators and representatives, officials of Protestant churches, and members of Congress frequently sign from one to thirty applications. It has been said by one well acquainted with existing conditions that "few men, least of all those connected with politics, dare refuse requests to aid applicants for licenses." There is an average of one saloon to each five hundred and sixty-two of the population. Liquor dealers are largely restrained from illegal practices by the fear of losing their licenses. "The improved character of the saloon," says the committee's agent, "is remarked upon by all observant citizens. Sunday selling has ceased, and minors are usually kept out of the saloons. The wholesale dealers have stopped selling liquor to be consumed on their premises. In many places great care is taken not to sell to persons already visibly under the influence of liquor."

The agent reports a large number of "speak-easies" or "kitchen bars" in Philadelphia which political entanglements or bribery prevents the police from suppressing. Liquor-selling goes on also in a multitude of clubs, so called, some of which are recognized political

factors. Pittsburg, with its large element of mill workers in its population, and most of its more intelligent citizens absorbed in money-getting, has only a lax enforcement of the liquor law, while in the large towns of the mining districts conditions are still worse. In Berks County, an agricultural region, are many inhabitants of German descent who insist on having plenty of hotels where they can get their beer.

Prohibition has been thoroughly tried in the West, in the State of Iowa. When the Clark act, which materially strengthened the prohibitory law already existing, was passed in 1886, it closed saloons by wholesale. At the same time it greatly stimulated the trade of drug stores in alcoholic liquors, and led to many sham drug dispensaries being opened.

"But the drug store was by no means the only source of supply," says Dr. Wines, who reports on this State. "Secret and illicit sales were common. The amount of supervision and espionage necessary to prevent them was beyond the reach of municipalities, even where there was a disposition to suppress illicit traffic. The schemes adopted in order to avoid detection were varied and ingenious. The man who went around with a concealed bottle upon his person, and dispensed drinks of the vilest composition in back alleys, was known as a 'boot-legger.' Few dealers sold openly. They had a store of liquor in one place, from which hidden pipes conveyed it to another, where it was dispensed; the faucets through which it was drawn were cunningly placed, out of sight, in the most extraordinary places. Or the liquor was in a cellar or subcellar beneath a secret trapdoor, and was sent up, on receipt of the price, by means of a concealed hoist or dumb waiter; or a step in a stairway was so constructed as to lift up, on hinges, and reveal a well-filled glass; or the glass was sent in through a partition wall by means of a revolving closet. There was no end to these devices, in most of which the customer did not see the man who supplied the liquor, nor the dealer the man who drank it." In rural and temperate communities these evils did not exist. On the other hand, there were counties in which the law was evaded with the collusion of officials, or was openly defied.

Prohibition had been inaugurated as a political move, and for some years served its purpose well. But the party that had taken it up found it growing unpopular, and in 1894 an end was made of prohibition in Iowa by the passage of a mulct law.

The idea of the mulct law was borrowed from Ohio. By the Dow law of that State the traffic is neither prohibited nor licensed; it is simply taxed, and many of the usual restrictions are thrown around it. The tax is two hundred and fifty dollars a year, and is

a first lien on the premises occupied. The dealer is civilly liable for loss and damage resulting from the intoxication of any person to whom he may have sold or given any intoxicating liquor, and this liability extends to the owner of the premises. The guardian or any near relative may enjoin the sale of liquor to any individual. The law provides also for local option as to prohibition.

Statistics indicate some decrease of drunkenness in public since the law has been in effect. The law has not taken the saloon out of municipal politics, although there has been in ten years only one election of State officers in which the liquor question is thought to have affected the result. The dealers are impatient of any restrictions, and are constantly working against a strict enforcement of them. That against selling on Sunday is especially irksome to them. In Cincinnati the police declare it to be impossible to close the saloons on that day. The dealers are arrested, but juries can not be got to render verdicts of guilty. Public opinion is not behind the Sunday-closing law.

No recent attempt of any State to solve the liquor problem has attracted so much attention from the rest of the country as the dispensary system of South Carolina. It has become conspicuous from the vigor with which it has been enforced by Governor Tillman, who suggested it, and the resistance that has been offered to this enforcement rather than from novelty in the plan itself, for its chief feature is simply the town and city liquor agency of Maine adopted from Athens, Ga., where it had been tried with success. The dispensary law provides for one dispenser at the county seat of each county, and permits county boards of control to establish dispensaries in other towns. There is a State commissioner who buys the liquors, and is required to give a preference to distillers and brewers in the State. Every package of liquor must be sealed and bear a certificate that it was bought by the commissioner; a package shall not contain less than a half pint nor more than five gallons. The local dispenser shall not break the seal of any package; he must sell by the package only, and the purchaser shall not open a package on the premises.

The law effected a general closing of saloons throughout the State, but many unlicensed dramshops, called "blind tigers," took their place. At the time of the committee's investigation there were eighty-one dispensaries in operation. Buying the dispensary liquors from South Carolina distillers has led to the purchase of much liquor that was not sufficiently aged, and hence highly intoxicating. Many ardent prohibitionists denounce the participation of the State in the "unholy traffic." Well-digested statistics show an unmistakable decrease of drunkenness and disorder in the cities,

but in some country districts an increase is reported. In the opinion of Mr. Koren, "so far as the cities and towns are concerned, the dispensary system has already reached the limits of its usefulness as a temperance agent. Any further addition to the State liquor shops in the cities where they already exist would be a direct invitation to drink. With the law so generally and rigidly enforced as at present, any multiplication of dispensaries in semi-rural districts can have no other purpose than to raise revenue and put more wheels into the political machine."

From the reports prepared by its agents the subcommittee draws the following conclusions: Prohibition has abolished or prevented the manufacture on a large scale of alcoholic liquors within the areas covered by it. Its success in suppressing the retail traffic depends upon the state of public sentiment in each locality. The efforts to enforce it have led to hypocrisy and unfaithfulness in public officials, to bribery and corruption, and to disrespect for law. Its general effect with regard to diminishing drunkenness remains a matter of opinion, no demonstration being yet attainable after more than forty years of experience. The prohibition over small areas that is secured through local-option laws has the advantage of always having public sentiment behind it. One of the chief objections to the license system is that it compels the liquor traffic to be in politics for self-protection. The enforcement of common restrictions on the sale of intoxicants is also dependent on public opinion. The removal of private profit from the liquor traffic is a desirable end for which no American legislation has yet proved effective. It can not be positively affirmed that any one kind of liquor legislation has been more successful than another in promoting real temperance. The influences of race or nationality are apparently more important than legislation. It is often said that restrictions on drinking at public bars tend to increase drinking in private, and there is probably truth in this allegation. All things considered, however, the wise course for a community is to strive after all external, visible improvements, even if it be impossible to prove that internal, fundamental improvement accompanies them.

BIRDS have curious ways in the selection of materials for their nests. An oriole's nest found by M. Marcel Plaideau near Lille, Belgium, was composed of white wool and Morse telegraph paper, which the bird had to go three kilometres to the nearest telegraph office to get. It might be suggested that the bird knew in some way how warm a covering paper makes; but then we hear of nests near Besançon, France, made of watch-spring steel; and a bird is told of that robbed a St. Bernard dog of his hairs to construct a nest.

AN EARLY AMERICAN EVOLUTIONIST.

By CHARLES MINOR BLACKFORD, JR., M. D.,
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AS a general rule, the influence of the theory of evolution as a potent factor in the biological sciences is considered to date from the publication of the *Origin of Species* in November, 1859. It is true that the theory did not originate with Mr. Darwin. It may be traced in more or less definite shape through the whole history of philosophy, and in our own century Lamarck * formulated a doctrine of development as fully as could be done with the data at hand in his day. The *Origin of Species* was fortunate in finding an expositor so simple and clear in style, so accurate and full in scientific knowledge as Mr. Huxley. Equally at home before the British Association for the Advancement of Science or a Workingmen's Lyceum, he brought to his subject the same conviction of right, the same strong, vigorous English, and the same rigorous logic that had enabled him at the age of thirty-five to face the Bishop of Oxford, and Owen, the foremost anatomist of his time, and vanquish each in turn before the greatest assembly of scientific students that gathers in Great Britain. With such a disciple and apostle it is not wonderful that the name and fame of Darwin should have been indissolubly connected with evolution, although his chief work in relation to it was an effort to determine the precise means by which variation was perpetuated and increased.

How the religious world rose in arms at the suggestion of such a hypothesis is well known. From the College of the Propaganda to the most extreme of the dissenting churches, all shades of religious opinion united to denounce the theory and those who upheld it, and the echoes of the conflict have not died away even now. Under these circumstances it is with a curious interest that we examine a work that was issued a few months before the *Origin of Species* saw the light, and, after seeing how fully it foreshadowed the later work, compare the approbation with which religious leaders hailed it with the denunciation heaped on the other by the same writers.

The title-page reads: *The Testimony of Modern Science to the Unity of Mankind, being a Summary of the Conclusions announced by the Highest Authorities in the Several Departments of Physiology, Zoölogy, and Comparative Philology in Favor of the Specific Unity and Common Origin of all the Varieties of Man.* By J. L. Cabell, M. D., Professor of Comparative Anatomy and Physiology in the University of Virginia. With an Introductory Notice

* *Philosophie Zoologique.* Par J. Lamarck. Paris, 1809.

by James W. Alexander, D.D. New York: Robert Carter & Brothers, No. 530 Broadway, 1859.

Such is the wording of this title that it received the indorsement of no less an authority than Dr. Alexander, and the "intro-



JAMES LAWRENCE CABELL.

ductory notice" is full of the highest praise of the work and of its leading idea.

Americans may well be proud of this book, as it states many of the biological laws now recognized, and, strange to say, cites many of the very instances used later by Huxley and Darwin to support them. Among these we find, on page 22, that by changing food and environment, "we may modify to an extent sometimes quite considerable the outward structural character of many plants and low animal organisms; and these newly acquired characters may then be perpetuated by hereditary transmission, under the influence of the law of assimilation between parent and offspring, even though the causes which originally determined the variation from the primi-

tive type have ceased to operate. A similar effect is produced in those cases in which a given variation appears accidentally in a single individual and is then transmitted to his offspring. . . . In other words, a permanent variety is likely to arise." In the *Origin of species*, Chapter I, in speaking of variations, Darwin says: "We are driven to conclude that this great variability is due to our domestic productions having been raised under conditions of life not so uniform as, and somewhat different from, those to which the parent species had been exposed under Nature." The same idea is here expressed in somewhat different words, and Darwin's notion as to the transmission of such peculiarities by heredity is too familiar to be repeated.

As an illustration of the law thus laid down, Cabell cites the well-known story of the origin of the Ancon or Otter sheep from a spontaneous variation occurring in the flock of Seth Wright in Massachusetts; and it may be remembered that Huxley uses the same incident in the same relation, but without reference to its previous use by Prichard and Cabell. As further evidence, he brings forward the changes arising in the horses and cattle that were brought to this continent as domesticated animals, but escaped into the forests and plains, and shows that without admixture—for these animals are not indigenous—varieties arose differing from the parent stock so markedly as to constitute new species. On the other hand, he shows that the hog, an exotic animal brought here under domestication, reverted to the primitive stock. So striking is this that it will repay copying in full (page 31):

"The hog is known not to be indigenous to this country, but was introduced into St. Domingo at the first discovery of that island in 1493, and successively to all the places where the Spaniards formed settlements. These animals multiplied with great rapidity and soon invested the forests in large herds. At length, under the influence of their wild state, they have resumed the characters of the original stock—that is, their appearance very closely resembles that of the European wild boar, from which the domesticated breeds have sprung. Their ears have become erect, their heads are larger, and their foreheads vaulted at the upper part; their color has lost the variety found in the domestic breeds, the wild hogs of the American forests being uniformly black. The hog which inhabits the high mountains of Paramos bears a striking resemblance to the wild boar of France. His skin is covered with thick fur, often somewhat crisp, beneath which is found in some individuals a species of wool. Thus the restoration of the original characters of the wild boar, in a race known to have sprung from domesticated swine brought over to America by the Spaniards, removes all reason for

doubt, if any had existed, as to the identity of the wild and domesticated stocks in Europe, and we may safely proceed to compare the physical characters of these races as varieties which have arisen in one species." (Unity, etc., pages 32, 33.)

As will be remembered, the leading instance of reversion cited in the *Origin of Species* is the tendency of fancy breeds of pigeons to return to the "blue rock," from which fact Mr. Darwin concludes that to be the original stock. As the hog is a more highly organized animal than the pigeon, this flexibility of species in it is more striking than in the oviparous pigeon.

As suggested above, it is probable that much of the interest excited by the *Origin of Species* was due to the brilliant exposition of Mr. Huxley; but, aside from that, unquestionably the chief reason that so many without the ranks of professional biologists discussed its reasoning so eagerly and earnestly was the bearing it had on the genesis of man. Mr. Huxley's lectures touched almost every branch of modern science—zoölogy, bacteriology, geology, sociology—all were equally familiar to this, perhaps the greatest public lecturer of our race, but to none of them did the laity give the rapt attention that was and still is given to evolution. The bearing of spontaneous variation among the lower orders of living organisms on the human race was clearly seen by Dr. Cabell, and the object of his work was to offset the arguments of those who claimed a plurality of genera among men by showing that lower organisms develop varieties without the intervention of any supernatural creative power. As a necessary inference from this, and, indeed, that it should have any bearing at all on the problem of humanity, he must have held that there was no radical difference between man and other animals.

The similarity between the arguments used by Cabell and those to be used a few months later by Darwin is striking, and equally remarkable is it that both should have foreseen objections to the theory, and that these objections are essentially identical. The difficulty of defining species as distinct from variety impressed them both; the alleged sterility of hybrids, an objection answered by both by showing it not to be invariable; the lack of intermediate forms, attributed by Darwin to the imperfection of the geological record and by Cabell to imperfect geographical knowledge, and several similar instances, can not fail to impress an attentive reader.

This neglected volume is a wonderful monument of painstaking labor and erudition, and although overshadowed by the more extensive works that appeared a few months later from the great English writers, it is one in which American biologists may take pride. Most remarkable, however, is the fact that it was greeted with de-

light and exultation by the leaders of religious thought, whereas the work of Mr. Darwin, hardly more than an expansion of Cabell's Unity, in which the same arguments and many of the same instances appeared, was denounced with all the vigor of ecclesiastical vituperation. The reason for this difference in reception is not easily seen.

EXCURSIONS OF THE RECENT INTERNATIONAL GEOLOGICAL CONGRESS.

By PROF. DANIEL S. MARTIN.

THE recent meeting of the International Congress of Geologists at St. Petersburg has led incidentally to an important series of publications regarding the geological features of a large portion of European Russia, the Urals, and the Caucasus. Everything connected with the meeting was arranged upon a most extensive and liberal scale, and especially the great series of excursions before and after the congress. For these there was prepared a set of handbooks, describing the leading points of geological structure and economic importance, and bringing together a great body of results of recent study, either unpublished before or scattered through various Russian and German periodicals and transactions, and practically inaccessible to the ordinary student. These handbooks or "guides" were prepared with great care by a number of prominent Russian geologists, who divided the routes of the excursions into sections, and went over them in detail during the previous year. When completed the reports were translated into French (a few into German) and beautifully printed as octavo pamphlets. These, to the number of thirty-four, were bound together in a volume of six hundred and forty-eight pages, with a spring cover, such that each paper could be taken out and used separately during that part of the journey which it described.*

The general editor, Prof. Th. Tschernytschew, observes, in his very modest introduction, that this is the first publication of the kind that has been issued in Russia; and while it can not be placed in comparison with such great general works as have appeared in other lands, like Oldham's *Geology of India*, Woodward's *Geology of England and Wales*, or Lepsius's *Geologie von Deutschland*, he hopes that it may yet present to students a more complete and "up-

* Guide des Excursions du VII. Congrès Géologique International; avec 39 planches, nombreuses figures, cartes locales et une carte géologique de la Russie d'Europe à l'échelle de 1:1,000,000. St. Pétersbourg: Imprimerie de M. Stassulévitch, Wassili Ostrov, 5 ligne, 28, 1897.

to-date" outline of the geological features of Russia than has before been attainable.

The volume was prepared for members attending the congress and presented to them. The very few copies that have reached this country have been brought by American delegates who have lately returned. Whether, or how far, the work will be procurable hereafter through any ordinary channels does not yet appear. It is to be hoped, however, that at least our scientific institutions and libraries may be able to secure copies of so valuable a treatise.

The general outline of the excursions was as follows: During the month prior to the meeting, a journey to the celebrated mining and mineral regions of the eastern Urals, the route being from Moscow by rail south and east, by Penza to Oufa, passing through the Urals to Zlatoust; then by the Ural Railway, which runs parallel to the mountains on the Asiatic side, north to Ekaterinbourg and the mining district of Tagilsk; thence recrossing the Urals to Perm, and from there by steamer down the Kama and up the Volga to Nijni Novgorod and back to Moscow by rail.

After the congress another great trip was arranged for—to southern Russia, the Caspian, the Caucasus, and the Crimea; this comprised several selections or "variants." The main route was from Moscow to Vladikavkaz in the Caucasus, one section going by rail through the valley of the Don; another proceeding by Kiev and taking the Dnieper valley; and a third going to Nijni Novgorod, and by steamer down the Volga to Astrakhan and on the Caspian Sea to Petrovsk; and all meeting at Vladikavkaz. From this point the route led by the great military road of Georgia, south to Tiflis, and thence to visit the oil deposits at Baku on the Caspian, returning by Tiflis to Batoum on the Black Sea, and by steamer to the Crimea, the excursion breaking up at Sebastopol.

A number of side trips to points of special interest were further associated with these excursions, and there were also two shorter excursions—one to Esthonia and one to Finland—for the study of early Palæozoic and Archæan rocks and glacial deposits.

These outlines are necessary in order to give an idea of the extent of country covered by the series of guidebooks that compose this notable volume. The first monograph is a description of the geology of Moscow and its environs, by Professor Nikitin; the last, by Prof. F. Schmidt, deals similarly with the vicinity of St. Petersburg. The remaining thirty-two take up *seriatim* the districts traversed by the several excursions and "variants." Nearly all of them are freely illustrated with sections, maps, diagrams, etc.; some have interesting views and photographs, and the more important have

complete references or bibliographies of the previous work done in the regions described.

All that can be attempted in a brief outline like the present is to indicate the general scope of the principal papers, and to refer to certain points presenting special interest.

Following the general course of the first excursion, which is all that can be done in the present article, we have three papers on the geology of the route through central and eastern Russia to the Ural Mountains. Much of this great region has been little studied since the classic researches of Murchison, save that in recent years several Russian geologists have been engaged upon it at various points; but their work is largely inaccessible, and much of it is not yet published. Article No. 1, on the environs of Moscow, and No. 2, from Moscow to the city of Oufa, are by Prof. S. Nikitin; No. 3, by Professor Tschernitschew, covers the route from Oufa to the eastern slope of the Urals.

In the whole vicinity of Moscow the general section gives, beneath the modern surface deposits, two well-marked Quaternary divisions, resting upon Cretaceous beds (Neocomian and Aptian), and these upon an important body of what Nikitin has termed Volgian deposits, upper and lower. Beneath these are Jurassic beds (Kimmeridgian to Callovian inclusive), underlaid by Carboniferous strata of the stage called here Moscovian. The Quaternary deposits consist of a widespread morainic boulder clay, unstratified, and filled with transported stones from Finland and northern Russia; westward this passes directly into the lower "Geschiebelehm," or Saxonian boulder clay, of the Germans, and is the product of the great Russo-Scandinavian ice sheet. Above this is an unstratified boulder sand, and below it lies a stratified boulder sand, the latter containing a larger proportion of material from the rocks of the vicinity. Professor Nikitin holds strongly that here, and through the whole of central Russia, there was but one period of ice-covering and moraine deposit, with no indications of repeated advances or of interglacial beds. The upper boulder sands he refers to the period of retreat of the great Russo-Scandinavian glacier, and attributes them to the action of streams and melting ice.

The chief point of novelty and interest, however, in this Moscow section is the relation of the upper and lower Volgian beds, which are important formations over a very large area. They have been variously considered by different explorers of late, some regarding them as lower Cretaceous, and others as upper Jurassic. Their stratigraphic position is clear; their fauna shows marked Jurassic relations at the base and Neocomian relations in the upper portions. Professor Nikitin regards them as a distinct series, lying between the

upper Jurassic and the Cretaceous and connecting the two; so that there is not in Russia any such gap between these systems, in his view, as is recognized in western Europe. The fauna, however, requires more detailed study before positive results can be assured. He gives much space to this discussion, in which we can not follow him here.

The Jurassic beds below present a close correspondence throughout the whole of central Russia to those of the north and west of France, and no marked differences can be observed.

The Trias and the Permian are here wanting, and the Mesozoic rocks lie directly on the limestones of the "*Etage Moscovien*" of the middle Carboniferous. Both are fairly rich in fossils, and at the base of the Callovian is a conglomerate in which characteristic Callovian fossils are intermingled with rolled fossils of the underlying Muscovian.

In the journey southward and eastward, from Moscow to Riazan, Penza, Samara, and Oufa, these same rocks occupy the greater part of the way, with much of interesting discussion, until some other features begin to appear as the route approaches the Volga, which it follows from Syzran to Samara. The lower Quaternary bowlder clay begins to disappear and gives place gradually to an upper series of deposits of mingled fluvial and æolian character, the most marked of which are the "loess" and a heavy "terrace clay" of the valleys, with a variety of intermediate types.

At Syzran the general uniformity of the structure is broken by an anticlinal elevation, in a north-to-south course, crossed by an important line of fault, west-northwest and east-southeast. These movements have produced a line of hills, which have deflected the course of the Volga, and are the only examples of the kind in this extensive region. Professor Nikitin places the period of their elevation in the early Tertiary.

At this point a very interesting feature first appears—the occurrence of deposits laid down by the former extension of the Caspian Sea. They are first seen near Syzran, in a baylike portion of the valley of the Syzran River, and thence become more marked in traveling eastward. They are chiefly clayey sands and conglomerates, with rolled pebbles of the underlying Cretaceous rocks. They appear on the divides and higher portions of the banks of the Volga and its affluents, and are evidently older than the "terrace clays" of the upper Quaternary. At many points they contain brackish water shells of late Caspian type. We have here the evidence of the Pleistocene extension of the Caspian waters over the great valley of the Volga as far north as latitude 53°, and even farther.

Crossing the Volga near Samara, the route enters upon a wide

valley which passes gradually into the great trans-Volgian steppes. Much interesting discussion as to the peculiar soils of the steppes and their relations to geology and to tree-growth can only be alluded to. In proceeding eastward the great Permian formation, so named by Murchison, begins to appear, forming a broad band or zone stretching along the western base of the Urals. The "tchernozem" or surface soil of the steppes rests upon successively older rocks as the route passes northeastward from the Volga toward the mountains. Beneath it appear more or less of the Caspian deposits, partly overlaid and partly connected with the "terrace clay" of the Quaternary. The underlying rocks are in succession Cretaceous, Volgian, Jurassic, and Permian, as this wide area is traversed. Permo-carboniferous and Carboniferous rocks are met on entering the Urals, the lower members of each appearing successively, and, when the folds of the mountains are fully reached, a great body of Devonian.

Between Samara and Oufa, as the steppes rise, the country presents an aspect which Professor Nikitin observes as strikingly like the eroded plateau regions of the western United States. This is particularly well marked in the valley of the Dioma River, where high level regions of nearly horizontal stratified sediments have been worn down along all the drainage lines into scarped and picturesque heights, with broad, flat areas of intervening watershed—as we should call it, a country of cañons, mesas, and "mauvaises terres."

The rocks of this region are principally Permian, but the Russian geologists are not fully agreed as to the details. A great body of limestones, marls, and sandstones, definitely of upper Permian age ("Zechstein"), lies between two distinct series of "*marnes irisées*"—red and variegated marls. The lower of these is undisputed (the "Rothliegender"), but the upper is regarded by some as also true Permian, and by others as transitional to the Triassic. For this upper series the name "Etage Tartarien" is employed.

It is interesting to note how much more continuous the geological succession appears to be here than in the west of Europe. The recognition of the Permian itself, as a whole, was an immense advance in this direction; and now we can almost trace it downward through the Permo-carboniferous and upward through the Tartarian, connecting the Palæozoic and the Mesozoic continuously. In the same way, and in almost the same region, the Volgian series appears to unite the Jurassic with the Cretaceous.

From Oufa to and through the southern Urals the description is taken up by Professor Tschernitschew. The structure of the Urals bears some marked resemblances to that of our Appalachians; the general course is much the same, north-northeast to south-south-

west, and the principal character is that of a series of parallel folds, with the anticlinal crests eroded into longitudinal valleys, so that each axis of elevation produces two parallel lines of heights. Similarly, too, the disturbance increases from the west eastward, and metamorphic and intrusive rocks appear and attain a great development toward the Asiatic side. Beyond, moreover, forming a separated though intimately connected portion of the system, are the Ilmen Mountains and others that align with them, highly metamorphic, much intruded, and exceedingly rich in mineral treasures. These recall our Blue Ridge range in its geographical relation to the Alleghanies, though their connection with the Urals is much closer geologically. Finally, the Ural range, like our true Appalachians, is monogenetic—i. e., the product of a single period of elevation.

The body of the southern Urals consists of Devonian and Carboniferous beds, much inclined. The latter are principally limestones, while the former, largely also calcareous above, become more fragmental lower down. The succession of stages is very regular in each, and is discussed at length. In the lower Devonian (Hercynian) occurs a hard and heavy sandstone, which by its resistance to erosion forms generally the crests of the parallel ridges. This sandstone not only passes into quartzite, but becomes at times micaceous and takes on a distinctly metamorphic habit. Professor Tschernitschew gives a clear and detailed account of the gradual passage of this sandstone into various kinds of micaceous, talcose, and chloritic schists. In the eastern Urals intrusive rocks appear more and more, mainly granites and diabases. Of these there are again many particulars given, and especially interesting accounts of the contact phenomena, where these dikes and veins have traversed the sedimentary rocks and produced local alteration.

In regard to Quaternary deposits the remarkable fact is brought out that there are no definite traces of glaciation in the Ural Mountains south of latitude 61°. All the surface deposits are local, either the work of streams or from the decomposition of rocks in place, after the manner of our "southern drift." For this latter process and its results the words "*éluvion*" and "*dépôts éluviales*" are used in these treatises in distinction from material removed and redistributed by flowing water—a convenient and desirable term. Most of the gold placers of the Urals are of these kinds—alluvial in some places and eluvial in others, but not glacial. In some cases the auriferous gravel and sand can be traced downward almost directly into the disintegrating quartz of an outcropping vein.

The main Urals are rich in iron ores, chiefly hematite and spathic iron; in the Ilmen range the ore is magnetite and occurs in a differ-

ent geological relation. The oxide and carbonate are associated with dolomitic limestones of the lower Devonian, and may be traced into them by a gradual transition, as at the mines of Bakal, where the ore is hematite for some distance below the surface, then passes to spathic iron, and this into dolomitic limestone at a considerable depth.

After traversing the Urals to Zlatoust, where are the great iron and steel works that produce some of the finest weapons used in the Russian army, and that sent an elegant exhibit to the Chicago World's Fair, the excursion traversed the famous mining and mineral region of the Ilmen Mountains northward to Tagilsk and Ekaterinbourg. This portion of the route is treated of in several papers as follows: The Eastern Slope of the Urals (No. 5), by Prof. A. Karpinsky; The Minerals of Kussa and Miass (No. 4), by A. Arzruni; The Gold Deposits of the Southern Urals (No. 6), by N. Wyssotsky; The City of Ekaterinbourg and its Environs, especially in Reference to Prehistoric Archæology (No. 7), by Dr. O. Clerc; The Mining Districts of Tagil and Gora-Blagodot (No. 9), by Professor Tschernitschew; and one or two minor articles.

Professor Karpinsky gives an admirable account of the region of the eastern Urals and beyond, emphasizing the contrast between the two sides of the system. While the western slope passes by gradual and gentle undulations into the plains and steppes of European Russia, the Asiatic side has been enormously eroded away. A wide belt of country along the eastern base of the Urals, consisting of upturned and folded rocks identical with those of the mountains, has been leveled down to an absolute plain. Over this are spread the deposits of the Tertiary sea that reached in Pliocene time nearly to the central ranges of the Urals, and that has largely obliterated their eastern portion. These deposits stretch far away into the great Siberian plain. Along their western edge, and for some distance eastward, they are strewn with lakes—some fresh and some salt; some deep and narrow among the folds of the edge of the mountain region; others broad, shallow, and with flats and benches of gradual contraction in the level country to the east. Two striking views of this lake-bestrewn plain from the top of some of the Ilmen peaks are given in the monograph.

The gold of the Urals, of course, receives much attention in these papers; the placers are carefully described, and the quartz mining also, which in some districts is overtaking and surpassing the placers in output. Closely connected with these are the platinum workings, thus far wholly surface deposits. But it is of great scientific interest to note the definite tracing of this metal to its original rock source, associated with chromic iron in serpentines, which

themselves are altered peridotites. These facts are not actually new, but they are recent and little known.

Especial interest gathers around two great mineral and mining centers—Miask, at the southern base of the Ilmen Mountains, and Tagilsk, toward the northern part of the route, near Ekaterinbourg. The rocks of all this region are metamorphic and intrusive, of great variety, and are described in some detail. At times the limestones are not so changed but that they retain determinable fossils (Devonian). The Miask region is remarkable for the varied and in some cases peculiar character of its rocks and the great number of minerals contained in them; the locality is celebrated in this respect, but can not be dwelt upon here. The Tagilsk region is notable for its great iron and copper mines; the former are magnetite masses so intimately associated with porphyry that Professor Karpinsky can only regard them as of similar and contemporaneous origin. There are several great mines in and around the rather isolated porphyry hill, Mount Wyssokaia; of these the oldest is that of Nijni Tagilsk. Adjacent to it, below the hill, is the copper mine of Mednoroudiansk, which has furnished all the beautiful Siberian malachite so familiar in collections and in Russian works of art. Unfortunately, the name of the iron mine, Nijni Tagilsk, has so long been connected with the malachite that the error can scarcely now be corrected. This name, however, is that of the district as well, and so may be used for the copper locality in a general sense.

The copper ores are a later deposit, amid tufas connected with the porphyry of the hill.

From these points the railroad turns westward, crosses the main Urals, here not very elevated, and gradually descends to the city of Perm. The route traverses much the same succession of rocks, in reverse order, as was described in approaching the mountains from the east. This portion is treated of by Professor Krasnopolsky, and the steamer route on the Kama and Volga to Nijni Novgorod by MM. Stuckenberg, Nikitin, and Amalitzky. All these contain much of geological and geographical interest, but there is not space to go into further particulars.

From Nijni Novgorod, the city of the great annual fair, where fine sections of the several horizons of the Permian are directly covered by Quaternary loess-like clays, the party returned to Moscow. Here we must close this very hasty sketch, which can only give the faintest idea of the extent and interest of the tour through regions so little known and so little accessible to the majority of geological students.



THE FEAR OF DEATH.

By M. GUGLIELMO FERRERO.

MAN occupies in view of death a situation that is peculiar, for he is probably the only being that knows he has to die. The battle against death spurs an immense number of men to study and work; and all the great intellectual and moral creations in art, religion, and science have been produced under the influence of the feelings excited by the certainty of that event. Yet the psychology of the ideas and emotions relative to death is still to be constructed.

Man is not normally preoccupied with the thought of death. While he is in full vigor of health and strength he is not afraid of it and takes little heed of it. The idea that he will have to die some day rarely enters his mind, and when it does present itself it is so vague and relates to an event so uncertain as to the time when it will occur that no distress is produced by it. This inertia of the thought of death in the strong man follows from the important agency exercised by organic sensations in determining the psychical condition. We know that not only exterior phenomena acting on the sensorial organs that are directed to the outer world produce sensations in us, but changes of condition originating in the organism itself are also accompanied by sensations. The parts of the body that are by their situation withdrawn from the direct influence of external agents possess a special sensitiveness through which we perceive their changes of condition. One of these sensations, for example, is the feeling of fullness after dinner, the sign of an abundance of food in the stomach. The same stomach, empty, gives the painful feeling of hunger. In the field of organic sensibility sharply defined sensations are given only under abnormal conditions resulting from pathological disturbances. In a normal state they are very weak, and escape observation all the more easily because they differ but little in quality and intensity. But, being very numerous and continual, these sensations exercise a great influence over our psychical condition and sometimes indirectly determine the trend of our thoughts and the forms of our feelings. Thus, for example, the vivacity of mental images and ideas often depends on special conditions of organic sensibility. When an image or an idea is in opposition to the preponderant series of organic sensations with which the consciousness is occupied, a conflict takes place in which the image and the idea are nearly always vanquished. It is, for instance, very hard to form a lively conception of the pangs of hunger after having eaten a good meal; for the organic sensations of fullness proceeding

from the stomach blunt the fancy of the opposite. It is observable, likewise, that the feeling of pity is often associated with organic weakness, while strong, healthy, and vigorous men are less inclined to it. It is only possible if we are able to realize a lively representation of physical or moral weakness; but men whose entirely healthful and vigorous organization develops feelings of well-being and strength can form only the poorest conceptions of those conditions of feebleness that are in contradiction to the preponderant system of sensations.

These principles explain why the young, well, and vigorous man concerns himself very little about death, although he knows to a certainty that it is inevitable. In a sound body the organs send unprecise and indefinite sensations to the brain, which, however, all together give that feeling of vigor and physical well-being that might be called the general sensation of organic life. According with the psychological phenomenon we have described, this condition of organic sensibility is diametrically opposed to the production of vivid images of death. The thought of death is therefore vague, feeble, and without consistency in the larger number of minds; and it is not competent to call out very strong feelings or excite a terror that will arouse the instincts of preservation that are slumbering in the depths of the consciousness.

The same principle explains why it is that old people generally are the ones who are most afraid of death and do not like to have it spoken of in their presence. Everybody has observed how worried aged persons are and how they protest if sickness or deceased persons are mentioned; that they are extraordinarily pleased when they read in the papers the accounts that are given occasionally of some centenarian living in some remote district; and what extraordinary precautions they take to preserve their health. We might believe that old men are preoccupied with death so much because they feel it near; but other facts demonstrate that the abstract number of probabilities of dying is not an element of the fear of death. Men in some occupations, as sailors or miners, are continually exposed to the danger of death; but they, especially the youth among them, do not take sufficient thought of it to be disturbed or saddened by it. The greater vividness of old men's conceptions of death is most likely a result of the advancing weakness of their organs and physical sensations.

Man has to face not only the abstract thought of death: he often finds himself confronting the real danger of it. What are his conduct and feelings then? A number of curious facts indicate that violent deaths, provided they are not too slow, are easy and free from pain; it might be said that death excites hardly any horror

when it comes quickly and without previous announcement; so the confessions of some persons who have escaped the gravest dangers would make us believe. Mr. Wallace has recorded some incidents of this kind in his *Darwinism*, and says of them that those persons who have escaped from the clutches of a lion or a tiger experienced no physical or moral suffering in their peril. Dr. Livingstone describes his feeling when seized and shaken by a lion as a kind of stupor with no pain or terror, although he was fully conscious of what had happened to him; so a chloroformed subject is able to follow the operation without feeling the instrument. Mr. Whymper, when he fell several hundred feet on the Matterhorn, rolling from rock to rock till he alighted on a mass of snow which fortunately held him just clear of the edge of a precipice, although he received a number of contusions, felt no pain and did not lose consciousness, but simply speculated as to the number of tumbles he would still receive before it would be over with.

The questions arise whether the nervous shock occasioned by the accident produces a kind of insensibility which paralyzes, as it were, the feelings of fear and terror, or whether the affair goes on so rapidly that there is no time for the formation of all the complex of images and feelings that culminate in the fear of death. Livingstone's precise observation suggests that there is really a kind of acquired insensibility. His comparison of his condition to that of a subject under the influence of chloroform appears more than probable when we reflect that severe nervous shocks of every kind coming under the form of extremely violent and sudden sensations or emotions produce this sort of hypnotic anaesthesia. It is well known, for example, that if we fall and receive a rude shock we remain for some time unconscious, or at least with a diminished sensibility. The same effect is produced by a sudden affliction, as, for example, a surprise of very bad news; grief does not follow at once, but a kind of insensible stupor with only the most obtuse consciousness of pain and of self. Thus the nervous shock provoked by the tumble over the rocks or by lying helpless under the paw of a wild beast would produce a kind of semi-sensibility, in which the thought of death would present itself just like any other thought without exciting any fear or terror.

Another extremely interesting problem in psychology lies in the study of the thoughts and feelings of the sick with respect to death. Are they preoccupied in the course of their illness with this probable ending? Do they preserve the habitual carelessness of all mankind? What relation exists between the moral character of the patient, between the kind of disease, and the fear of death? I can not fully answer these questions for want of a suffi-

cient number of facts and observations, but will record what I have observed without assuming to give it the value of definite conclusions.

I have been much struck by the fact that patients afflicted with chronic and lingering diseases appear careless about death, and even have often an ardent confidence in life and hope to enjoy it long. The phenomenon is especially remarkable in consumptive patients, although they know well enough that science has no remedy for their disease, and only one of those miracles that sometimes are wrought in the organism can save them. Their belief in a near recovery is sometimes so strong that it takes the form of a real hallucination and a delirium. I can say nothing precise about those who suffer from acute diseases. There are those who remain sick, recover, or die without ever saying a word about death or showing any apprehension of it; others, on the contrary, are desperate, mourn their fate, and exhibit in their talk and acts poignant and profound anguish at the prospect of death. Still others manifest a resigned preoccupation and a regret modified by a Stoic recognition of the inevitableness of death. It is impossible now to say what the causes of these differences are; but the question is an interesting one. A most curious phenomenon is the fact that death sometimes loses its horrible character and is contemplated with real pleasure. Few psychological facts seem more strange and astonishing than this. The ancient Brahmanical custom of burning the bodies of widows with their husbands became almost a moral privilege for the women, and to many of them represented the magnificent ending of a beautiful existence. The attempt of the English to eradicate it was met by a strong opposition from the women themselves. A similar custom, though devoid of the religious surroundings, exists in China, where childless widows believe that they die well if they strangle themselves after the interment of their husbands.

Examples of pleasure in death are found, too, in countries of European civilization. It is true that the most remarkable cases of this kind occur among nervously diseased persons; but as their disorders are generally only exaggerations of normal tendencies, the psychological phenomenon is well worthy of attention. Death is sometimes sought as preferable to a threatened separation under the impulse of a strong emotion of love; and instances are cited in which couples have deliberately and elaborately prepared for it as if for a party of pleasure. Persons have been known to invite death, in the expectation of thereby promoting some scheme of vengeance. Savages of certain tribes who have been offended and have no other means of vengeance kill themselves, believing that their spirits will return to torment their enemy. Under the Hindu

custom of the Dharma, or fast, men starve themselves to death for the sake of annoying their enemies. So persons of disordered nerves among us, or victims of various passions, commit suicide in order to excite remorse in persons to whom they become antagonistic. Others die to gratify their vanity, and surround their death with conditions that will attract attention or that bear a character of sensational display. A great many suicides would probably never commit the fatal act, no matter how hard the miseries of life might oppress them, if they thought nothing would be said of the matter in the press or in society; while, in fact, a supreme satisfaction attends their departure from life in the anticipation of the talk there will be about it.

Persons in certain classes or occupations are attracted by particular modes of death. Thus death on the battlefield possesses a dazzling glamour for soldiers, in whose conception of it there is no thought of terror.

Death may further be made to appear pleasant through the operation of religious or political fanaticism. Multitudes of men have exposed themselves to the most terrible dangers of death, and multitudes of others have actually suffered it, full of enthusiasm and joy, for an idea, and have given themselves up to destruction for it. Such feelings acquire frightful intensity when they become epidemic and are propagated through a mass of people.

Such cases present a strange perversion of the instincts of self-preservation, which are ordinarily the firmest and strongest of our feelings—a contradiction to the most general laws of life so complete and distinct as to make a search for an explanation for it very desirable.

The explanation, we believe, may be found in the laws of association. Association is capable of changing the psychological value of any object, of rendering agreeable a thing that is offensive to another or under other circumstances, or an action by which others are annoyed or to which they are indifferent; and can give precious value to a recollection, a thought, or an image which would be repulsive to others. Such associations operate with striking force in cases where the passion of love is concerned. Associations connected with a place where one has lived are agreeable or disagreeable according as one has been happy or not there; and the law may extend to objects and images of all kinds, and even to the merest trifles.

By the same law we may account for these exceptional eliminations of the repulsive character from the thought of death. When it is associated with intense passion, with the anticipation of glory and fame, or when the gratification of animosities is the dominant

desire, all feelings contradictory of these suffer a total eclipse, and death becomes desirable as a means to obtain what to the passing fancy seems a greater and the supreme end.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

THE SYMBOLISM OF SALT.

BY MARIE GOLDSMITH WEST.

DR. WALTER JAMES HOFFMAN, in his paper upon Popular Superstitions, which appeared in the *Popular Science Monthly* for November, 1896, speaks of the ominous meaning attached to the spilling of salt at table. He traces the origin of this widespread belief to our Lord's Supper and consequent events. Now, this is an erroneous though not infrequent supposition, doubtless generated by Leonardo da Vinci's great picture of the Last Supper, where he represents Judas overturning the saltcellar as he reaches over the table to dip his hand in the dish with our Lord. As a matter of fact, mention of the superstition was made in works anterior to the time of Christ. It was a common belief among the Romans, and may even then have been a survival, since proof exists that this mineral was held sacred very early in the history of the human race.

The Romans began their feasts by prayers and libations to the gods. The table was consecrated by placing upon it the images of the Lares and saltcellars. A family saltholder was kept with great care, and to spill the salt at table was esteemed ominous.*

The prominence of salt as a religious and social symbol is doubtless due to the fact that it became a necessity to most nations at an early stage of civilization, and that it was a luxury very hard for primitive man to obtain in many parts of the world. There are still, even in this era of commerce, portions of central Africa where the use of this mineral is a luxury confined to the rich.

In ancient times and among inland peoples the possession of a salt spring was regarded as a special gift of the gods. The Chaonians in Epirus had one which flowed into a stream where there were no fish, and the legend was that Heracles had allowed their forefathers to have salt instead of fish.†

The Germans waged war for the possession of saline springs, and believed that the presence of salt in the soil invested the district with peculiar sanctity, and made it a place where prayers were most readily heard.‡

* Horace, *Od.* ii, 16, 14, *Test.*
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† Arist., *ut supra.*

‡ Tacitus, *ut supra.*

That religious significance should come to be attached to a substance so highly prized, and in many cases so hard to obtain, seems but natural, especially as the habitual use of the mineral commenced with the advance from nomadic to agricultural life—that step in civilization that is said to most influence the cults of the nations.

So important was salt to the ancients that it has been conjectured that the oldest trade routes were created for traffic in the article. Certainly, with the addition of incense, it plays the principal part in all that is known of the ancient highways of commerce. One of the roads in Italy is the *Via Salaria*, by which the produce of the salt pans of Ostia was carried up into the Sabine country, and to the present day the caravan trade of Sahara is largely dependent upon salt.*

Of old the gods were worshiped as givers of the fruits of the earth, and especially of bread and salt, which are always mentioned together. This mineral was associated with religious offerings, particularly cereal. Its preservative qualities made it the fitting symbol of an enduring compact; hence, probably, the “covenant of salt,” spoken of so frequently in the Bible.

Numbers, xviii, 19: “It is a covenant of salt forever before the Lord unto thee and to thy seed with thee”; and 2 Corinthians, xiii, 5: “Ought ye not to know that the Lord, the God of Israel, gave the kingdom over Israel to David forever, even to him and to his sons by a covenant of salt?”

These verses illustrate the importance attached to such compact. Not only were the gifts bestowed, but they were made enduring by “a covenant of salt.”

In the mountains of Salzburg, about 1730, there existed what was known as the “Salt League of God.” Menzel gives an account of the ceremony from which the association derived its name: “Each confederate on taking the oath dipped his finger in the saltcellar, and from this circumstance and the allusion it contained to the name of their country the league was styled by them the ‘Salt League of God.’”

The Mexicans personified their veneration for salt in the goddess *Huixtociatl*. She was said to be a sister of the rain gods, with whom she quarreled; in their resentment they drove her into the salt water, where she invented the art of panning the mineral, and became the goddess of salt.†

Next to its religious significance salt was, above all, the symbol of friendship. To eat salt with a man was held by most peoples, the Orientals especially, to form a sacred tie of brotherhood. Any per-

* Also see Herodotus's account of the caravan route uniting the salt oases of the Libyan Desert.

† Bancroft. Works on Native Races.

son who had the hardihood to disregard this obligation would have been considered a social pariah of the vilest description. In the *Forty Thieves*, Cogia Houssain refuses to go to table with his intended victim for fear he should partake of this sacred substance in his company, and thus be compelled to forego his plans. When hard pressed for his reason, he makes excuse for not accepting the proffered hospitality by saying, "I never eat of any dish that has salt in it." There is an allusion in the *Arabian Nights* (Burton's edition, I believe) to a robber who, wandering about in the dark in a strange house, stumbles on a small, hard object.. In order to ascertain its nature he puts it to his lips, and, discovering it to be salt, is compelled to abandon his burglarious intentions because, since he has tasted salt beneath that roof, he is forced to respect its master's property.

Omar Khayyam refers to the symbolical meaning attached to the mineral in the following lines:

"O wheel of heaven ! no ties of bread you feel,
No ties of salt, you flay me like an eel !"*

There were a number of other social usages connected with this mineral, from which have arisen various customs, superstitions, and representative expressions.

In ancient times it was customary to place the saltcellar in the center of the table. Above this sat the superiors, and below the inferiors; hence the expressions, "above the salt," "below the salt." Jonson, in *Cynthia's Revels*, illustrates their application: "His fashion is not to take knowledge of him that is beneath him in clothes. He never drinks below the salt."

Salt is also symbolical of wit, of sarcasm, of the good things of life, as—

"I never drank of Joy's sweet cordial
But Grief's fell hand infused a drop of gall ;
Nor dipped my bread in Pleasure's piquant salt,
But briny Sorrow made me smart withal." †

Another well-known expression—i. e., "To be worth one's salt"—doubtless owes its origin to an old custom that obtained in more than one part of the world—that is, using cakes of salt as money—for instance, in Abyssinia and elsewhere, in Africa and in Thibet, and adjoining parts.‡

In Colonel Yule's translation of Marco Polo, he devoted a note to the use of salt as a medium of exchange in the Shan markets down to our own times. Also in the same work details are given as

* Quatrains of Translations. E. H. Whinfield.

† Omar Khayyam. Translation by E. H. Whinfield. ‡ Marco Polo, book ii, chap. xlvi.

to the importance of salt in the financial system of the Mongol emperors. The substance stood as well for costliness, as, "He paid a salt price for it."

Another ancient practice connected with salt is alluded to in the Bible, Ezekiel, xvi, 4: "Thou wast not salted at all."

This refers to the custom of salting the skin of newborn babes. The operation was supposed to make the epidermis dry, tight, and firm. Galen speaks of the practice. It may also have been emblematic of purity and incorruption.

Superstitions concerning salt are widely scattered over the world. When the Chinese observe the last festival of the year, literally called "rounding the year," a portion of the ceremony consists in building a bonfire of pine wood before the ancestral tablets of the family. Upon the flames salt is thrown, and the crackling which it occasions is regarded as an omen of good luck for the following year.*

The mountain people of North Carolina and West Virginia are said to put salt in their shoes in order to keep off the witches. Bancroft related that one of the aboriginal tribes of North America refrained from eating salt in the belief that it turned the hair white.

Several curious customs, founded upon the ancient religious significance of salt, survived until a recent date. Such was the Eton Montem, or procession of the "Eton" boys to Salt Hill. Certain boys in fancy costumes went first, in order to levy contributions on the passers-by. These donations were devoted to the maintenance of their captain at college, and all who gave received a pinch of salt in return. Another well-known college custom, that of salting the freshmen before they were entitled to join in games with the others, may have had something to do with the naming of the new students; or it may, on the other hand, have been instituted as a boyish joke because of the name already given.

Though in some portions of America salt was introduced by Europeans, yet there were many parts where the mineral was accessible, and a number of native tribes besides the Aztecs held it in high veneration. One of the professors who recently visited the Zuñi villages on behalf of the Smithsonian tells of a curious custom of the people which, I believe, has not been published hitherto. The Zuñis, when organizing an expedition to go after salt, fit out a war party and take provisions greatly in excess of their wants for the time during which they will be gone. Since there is no object to be served by a war party in times of peace, it has been conjectured

* Social Life of the Chinese. Justus Doolittle.

that this practice is a survival from the days when the Zuñis were inhabitants of the cliff dwellings. By careful computation it has been ascertained that the amount of provisions invariably carried would be the proper allowance for the time consumed in a journey from the cliff dwellings to the place where the salt is obtained and back again.

From the careful preservation of all its features this salt-getting expedition would appear to have been at one time a ceremonial of religious importance. In the old cliff dwellings are found peculiar little bags containing salt; and at the present time a certain amount of the mineral, when brought to the villages, is set aside as sacred and preserved in little bags almost identical with those found in the ancient dwellings.

Where men live on milk and raw or roasted flesh, sodium chloride is an unnecessary addition. Thus the Numidian nomads in the past did not, and the Bedouins of Hadramant of the present do not, eat salt with their food. On the other hand, a cereal, vegetable, and boiled meat diet calls for salt. Livingstone's South Africa contains a very interesting passage treating this subject. The author says, speaking of the Bakwains: "When the poor who had no salt were forced to live on an exclusively vegetable diet they were troubled with indigestion. The native doctors, aware of the cause of the malady, usually prescribed some of that ingredient with their medicines. The doctors themselves had none, so the poor resorted to us for aid. We took the hint, and henceforth cured the disease by giving a teaspoonful of salt, minus the other remedies. Meat or milk had the same effect, though not so rapidly as salt. When I was myself deprived of salt for four months at two distinct periods, I felt no desire for the condiment, but was plagued by a longing for meat and milk. This continued as long as I was confined to exclusively vegetable diet, and when I procured a meal of flesh, though boiled in fresh rain water, it tasted pleasantly salt. Milk or meat or salt, obtained in however small quantities, removed entirely the excessive longing and dreaming about roasted ribs of fat oxen and bowls of cool, thick milk."

The consumption of salt has become almost a necessity to most peoples through long-continued habit; but, where tribes have been cut off from the use of it for a lengthened period, the taste for the mineral has almost or entirely died out. For instance, during the reign of Montezuma I, and from that time to the conquest, the Tlascaltec territory was completely surrounded by the Aztecs. Thus communication with the coast was prevented, and this people were compelled to do without salt among other luxuries. It became so rare that, though the nobles smuggled in a little for their own use,

the condiment became quite unknown to the common people, who quite lost their taste for it.*

In Pliny's time salt was considered a valuable medicament for various ailments. It was taken to neutralize the effects of opium, and above all it was valued as a cure for leprosy.

The most common artificial salt is made by evaporating sea water in salt pans. It is also produced by pouring salt water upon burning wood, the ashes of which are said to have almost the pungency of the true mineral. When thus prepared the salt is black. In Arabia, according to Pliny, so many salt mines were found that people resorted to them instead of quarries, building whole houses and even cities of this mineral. Gerrah was entirely composed of it.

One of the most remarkable salt mines in the world is at Wieliczka, near Warsaw, Poland. It has been worked since 1252, and at one time furnished the principal revenue of the kingdom. A vast number of people inhabit the subterranean passages of this mine, and are governed by laws and magistrates of their own. Each miner is allotted a little cell, where he dwells and rears his family. As many as eighty horses are kept in this underground republic to carry to and fro along the immense corridors which are supported by pillars of salt. When the light falls down the long vistas it makes the mine look like a crystal palace, of which the walls and pillars are tinged with delicate green.†

OUTSIDE of the timber belt, which begins at Monterey and extends at intervals to Oregon, there is hardly a mountain on the Coast Range of California, from San Diego, on the south, to Trinity, almost at the Oregon line, says Carl Purdy, in *Garden and Forest*, which is not in part covered by the chemise brush, or chemisal. The greater the distance from the ocean the larger the percentage of mountain lands which this hardy shrub has taken possession of, until many sections of the eastern part of the Coast Range are almost given up to it, and from the valleys to the mountain tops it holds a sway only shared by a few of the hardiest shrubs, oaks, and conifers. Hardly a spot is too steep to allow it a foothold, hardly a soil too meager to afford it sustenance. Fires sweep over and leave blackened stubs, but with its unusual vitality it soon starts a new growth. In a few years rocks, hills, and slopes are again masked by a close color of blue green, which gives to the mountains a softness of outline peculiar to the Coast Range, and very beautiful too, although the monotony of flowing lines often becomes tiresome. The chemise (*Adenostoma fascicularis*) is of the rose family, and is an evergreen with linear, heathlike leaves, a light-colored, stinging bark, and brittle wood. In late spring it produces an abundance of whitish flowers with green centers.

* Bancroft. Works on Native Races.

† Valmont de Bomare, tome v, p. 591.

THE TEACHING OF APPLIED SCIENCE.

By M. CH. LAUTH.

IN an article published a few months ago in the *Revue Scientifique* I pointed out a danger that threatens some of our chemical industries. I showed on the evidence of official documents that these very industries have taken a rapid start and had an immense development in Germany, while they have continued nearly stationary in France, the country of their origin. In the search for the causes of this standstill I believe I established that it is largely due to deficiencies in the chemical instruction given in France and to the indifference to industry manifested by our scientific men, while in Germany the teaching of chemistry has reached an admirable stage of perfection, and the alliance of science and industry is commended as a necessity of the first order. Like ideas have been developed recently in various publications; attention seems to be concentrating around the question, a happy sign which I remark with joy. M. Léon Lefèvre, who agrees with me in opinion on this point, speaks of the parallelism in the development of the color-making industry and of organic chemistry in Germany. "That country," he says, "now possesses the supremacy in both, and yet it did not assist at the birth of artificial coloring matters; for the honor of the discovery of the first aniline colors belongs to France and England"; and he calls attention to the very rapid growth of the Chemical Society of Berlin since that discovery was made in 1868 from 107 members to 3,129, as compared with that of the societies of London, 551 to 2,029, and of Paris, 269 to 736. M. Haller, director of the Chemical Institute of Nancy, presents a similar argument, and quotes Humboldt's prediction that those countries which neglect recourse to their scientific lights will see their prosperity inevitably jeopardized as neighboring nations develop and strengthen themselves under the vivifying influence of the arts and sciences. My opinion is further sustained by many other men of science from whom I have received letters. Some of them accuse our method of teaching, which, they find, has no direct bearing on the object for which the instruction should be given. One of them says it is all wrong, in that it gives prominence to the abstract and does not give importance to the application, and another finds fault with the method by which instructors are chosen and appointed.

We may look at the subject from another side and inquire whether manufacturers have done their best to keep their standards even with the highest. It will appear that the majority of French manufacturers do not appreciate as they ought the influence of sci-

entific work on the development of industry and the fatal repercussion which this incessant progress going on in the domain of pure science inflicts upon it. They therefore content themselves with improving their old methods and processes. Instead of inviting the co-operation of men of science and expert chemists, they continue to intrust the fate of their machines to simple overseers, capable enough of adjusting a machine of the old style, but incapable of devising a new process. Sometimes, it may be, they trust to some happy accident to help them against foreign competition and restore prosperity to their establishments without reflecting that the success of their rivals is exclusively owing to their strong scientific organization.

If, with a more enterprising spirit, they call in men of science to co-operate with them, they are most likely to expect an immediate return and to be discouraged if they fail to realize it; and dismiss their advisers because they can not perform the impossibilities they expect of them. Hence the sad misunderstanding which exists between men of pure science and manufacturers, the former repeating that industry offers no opening for their pupils and that it is of no use to direct them to a career that is ungrateful to them, and the latter affirming that they do not find among the chemists they employ the knowledge that will render their collaboration fruitful.

Misunderstandings of this kind will continue so long as professors charged with the direction of chemical studies do not take exact account of what will be expected of their students when they go into industrial occupations. It should be well understood that the manufacturer does not expect to find master workmen or good overseers in the chemists he engages. No one is capable of directing a factory without having followed for a considerable time the course of the several shops. This is not the part the chemist is to perform; nor is it his duty to keep an eye upon the workmen. He must first of all things—and it is an absolute condition—be in the current of the science, and more especially, of course, of the parts of the science that treat of the industrial branch to which he applies himself. He should be familiar with all the details of mineral analysis, qualitative and quantitative, of organic analysis and industrial analyses; and be skillful in delicate manipulations and preparations. He should be acquainted with what is required in the principal chemical industries and familiar with the most practical general methods in use for solving the problems that will be submitted to him, to such an extent as to be competent to improve in quality and value the manufactures which he will be charged with inspecting and perhaps directing. And he should, finally, have a taste for original research,

and be able ultimately to take advantage of his theoretical knowledge, so as to aspire to make discoveries that will place him in the rank of inventors—the dream of every chemist of any ambition. The young student who presents himself in industry with such a supply of knowledge will be sure to find for himself a most honorable place at once, and will have every encouragement to continue his studies for a year or two longer rather than present himself insufficiently equipped; for once in conflict with the daily difficulties inherent in every exploitation he will have no more time to learn.

It is not necessary to say that the “ideal” chemist does not exist in France, and with the kind of teaching that is given can not exist. Young men may indeed be found possessing a remarkable stock of theoretical knowledge and in every way capable of brilliantly sustaining their graduating theses, and some can even perform a mineral analysis or an organic analysis correctly. But I do not think I am too severe when I say that I believe that further than that they have only the vaguest smattering—and there is nothing surprising in that, for nobody has taught them more. For this I do not blame the science of the masters or the motive of the students. The teachers have not had their attention directed toward industrial affairs, and have not therefore been able to teach their students with reference to them.

The reform we need can not be introduced by the personal initiative of the students; for even if they should awake to the necessity and turn their minds to industrial research and the acquisition of practical knowledge available in the shops, they are powerless so long as they have to prepare for the examinations. Might we hope that the manufacturers should be disposed to favor special laboratories for the training of industrial chemists? Their effort would invoke our sympathy, but it would be many years before it would yield results; and all that time our rivals would be gaining on us.

The best remedy, it seems to me, is to look to the existing schools for measures to improve their methods and give their teaching a more practical, more industrial direction. Since I first called attention to this subject in 1878 a number of schools have been established where chemistry is specially and practically taught; but the results they yield will, I fear, always be incomplete so long as the direction of them is intrusted to purely scientific men. However eminent they may be, they are not familiar with what is wanted in chemical industries, and they can not familiarize themselves with it except by placing themselves in constant relations with the heads of great manufactories and studying their requirements, as is done everywhere in Germany.

A reform of the kind sought could be brought about without

great expense by incorporating upon the present programme systems of lectures and of manipulations; the lectures to consist of the exposition of the principal chemical industries, and the laboratory work of industrial preparations and applications; and the students should be exercised in comparing manufactured products and in studying the general methods pursued in industrial research, the processes adopted for increasing returns, and other branches of similar bearing. Such instruction demands special fitness—teachers who are familiar with industries and love them. That is the basis of the reform I propose. In order to teach the applications of science, to make known the methods, processes, and desiderata of industry, one must have studied and practiced them himself. He must himself have been a workman. Whatever may be the value of our masters, however great may be their intelligence, they can not develop knowledge in the minds of their pupils that is foreign to themselves, or make them adopt methods of labor which they have never themselves seen applied.

I have already received protestations from the teaching body against seeing men raised to the dignity of professors or lecturers—men who have not their diplomas as licentiates or doctors in science. But I really do not believe that the possession of these diplomas is indispensable to the purpose toward which I am looking; and I fancy that for the treatment of industrial questions it is sufficient to understand them for one's self.

The teaching of which I have thus sketched the programme might be given at the close of the studies of our young chemists and constitute the crowning of them. The reform I propose consists, then, simply in opening our chemical schools and institutes to lectures and manipulations in applied chemistry, and in confiding this special teaching to professors who have themselves been engaged in industry.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

It has long been a question how the priestly office became so associated with bridge-building that that function should have given their principal official titles (*pontifex, pontiff*) to the Roman chief priest and the Pope. An attempt at an explanation is made by Herr Rudolph von Ihering, in his *Evolution of the Aryans*, who says: "All the branches of the pontifical duties may be traced back to the original demands laid upon the technical bridge-makers of the migratory period; their priestly office, to the necessity of the expiatory sacrifice to the river god, which could not be offered by the *Flamens*, who were the priests of the national divinities only; their skill in writing, to the drawing of the plan of the bridge; their chronology, to the estimation of the proportions of the bridge; their relation to the law, to the claim of the river god upon the bridge toll."

THE LIFE HISTORY OF SCIENTIFIC IDEAS.

By M. GUSTAVE LE BON.

SCIENTIFIC ideas are subject to the same general law of evolution which we have expounded as to other ideas in a previous paper (*The Work of Ideas in Human Evolution*, *Popular Science Monthly*, vol. xlviii, August, 1895); but being less lasting than other ideas, the study of them is easier. Science does not escape the general laws that regulate the elements of every civilization. These laws, too, are derived from a small number of fundamental ideas variable in different epochs, and which stamp a deep mark on every science. All modern physics rests upon the idea of the indestructibility of energy; biology on the idea of transformation by selection, and pathology on that of the action of the infinitely little. It is a property of scientific ideas that they have a force much less relative than that of religious, political, and moral ideas, but they lack much of being absolute truths; and that is why we see the directing ideas of science usually changing every fifty years. All these ideas are most frequently nothing but provisional hypotheses. The only veracious side of them is that they explain for the given moment the largest number of the facts. Darwin's hypothesis of the evolution of living beings explains more facts than Cuvier's hypothesis of successive creations; and the hypothesis of luminous undulations explains more phenomena than the hypothesis that preceded it.

It does not matter that these great directing ideas are erroneous. If we place ourselves at the point of view simply of the advance of the human mind, it will hardly be a too rash assertion to say that error is infinitely more useful than truth. Absolute truths, or what are considered such, are not discussed any more and provoke no investigation. Ideas held as hypotheses, on the other hand, provoke much. The researches made for the purpose of defending or attacking the hypothesis of the emission of light and that of undulations begat the finest discoveries of optics. The much-debated hypothesis of transformism has produced more research within a few years past than was made in all the centuries gone before. During the epoch, on the other hand, when what Aristotle and Ptolemy wrote was held for gospel truth, there could be no research; and for several centuries science was contented with traditions and made no progress. The most fruitful method of investigation is by imagining some hypothesis and trying to verify it, and by modifying it as new facts come to light. The great advantage of scientific ideas is that their value can be speedily ascertained by experiment, while that of re-

ligious, political, and moral ideas is determined very slowly. We should not, however, suppose that they are established and vanish with any extreme rapidity. Their evolution is indeed more rapid than that of other ideas, but it follows the same phases. Its history shows that although they address themselves only to the most enlightened minds, it takes them not less than twenty-five years, and usually much longer, to establish themselves. The clearest of them, the least hypothetical, those most easy to demonstrate, those which would seem least subject to controversy, like the doctrine of the circulation of the blood, have not been accepted in less time. In other respects scientific ideas are established under the influence of the factors we have described as acting with other ideas—affirmation, repetition, contagion, and prestige—and perhaps we may add, since we are dealing with the scientific category, reasoning; but the action of this factor is so weak that we might properly omit it. When it intervenes it is chiefly to refute an accepted idea, not to establish a new one. The new scientific idea is rarely imposed, so far at least as the majority of minds are concerned, by demonstration. It must not be supposed that because a man cultivates science he is released from the yoke of established dogmas. Scientific dogmas are often the most tyrannical of all.

The scientific idea is pre-eminently established by the prestige of the man who imposes it, and rarely in any other way.* When Charcot introduced to science the phenomena of animal magnetism, which had been described for more than a century by students whose only fault was that they had no prestige, and whose admirable researches had been neglected for that reason by many generations of doctors, shall we suppose that the demonstrations of the professor were what convinced the medical public? Not at all, for the same demonstrations had been repeated thousands of times within a hundred years. The conviction was simply the result of the prestige of the expert, who did nothing but introduce into official science a series of phenomena which were perfectly known before him. After having been established by prestige the scientific idea goes through the

* It might be objected to this assertion that Darwin, who was without title, claim, or authority, had no prestige when he made his investigations. But it would be easy to answer, first, that his example is almost unique; and, second, that Darwin's doctrine was supported in England, as soon as it appeared, by men who had much prestige. I am, moreover, not sure that if Darwin had been born in one of the countries where mental worth is exclusively measured by the number of decorations it wears, the immortal book, the *Origin of Species*, would never have found a reader. The author would soon have been made to understand that, not being an academician or professor, he could only make himself ridiculous by taking up questions which had been long treated by the most illustrious specialists.

regular course of evolution. It is taken up by apostles who propagate it in a small circle, and it begins to spread. It at first meets with strong opposition, for it strikes forcibly against many ancient and established things. The apostles who have adopted it are excited by this opposition, which only persuades them of their superiority over the rest of men, and they defend it with energy, not, indeed, because it is true—for they generally know nothing about that—but simply because they have adopted it. The new idea is discussed and is accepted in whole by some and rejected in whole by others. Affirmations and negations are exchanged, but very few arguments; the only motives for the reception or rejection of an idea being, for the immense majority of minds, simply those of feeling, in which reasoning has no part. In consequence of these passionate contestations the idea progresses slowly. The young people who become aware of the contest adopt the idea readily, for the single reason that it is contested. To youth, eager to be independent, wholesale opposition to things that are accepted is the most easily accessible form of originality. The idea therefore continues to gain. As it is gradually accepted by official men of science it at length becomes propagated wholly by the mechanism of contagion, and insinuates itself, timidly at first, and then boldly, into the classical books. Its triumph is then complete. Like religious dogmas, it becomes a part of the things that are not disputed. We have only to recollect the history of transformism in France, and how the scandalous heresy has passed into the state of a classic dogma, to observe the successive series of these phases of propagation.

After having prevailed for a considerable length of time the idea begins to lose its hold and at last dies out. But before an old idea is wholly destroyed it has to go through a series of retrogressive transformations that require many generations for their accomplishment. Before vanishing forever it takes its turn in forming a part of the old hereditary ideas which we qualify as prejudices, but respect nevertheless. The old idea, although it is already nothing but a word, a sound, a mirage, possesses a magical power that still subjects us. At last it dies. After reigning long over a civilization ideas lose their prestige, fade away, and are extinguished. New discoveries disturb them. Belief in them becomes less general. Men begin to discuss them, and by the mere fact of discussion their death is near. Every great directing idea being generally a fiction, they can not submit to be discussed except on condition of never being subjected to critical examination. But even when an idea has been violently disturbed the institutions derived from it retain their vitality and are effaced very gradually. When it has completely lost its

power all that it upheld soon falls. It has not yet been given to any people to change their ideas without being at once forced to transform all the elements of their civilization.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

SKETCH OF JOSEPH PRESTWICH.

SIR JOSEPH PRESTWICH was, at the time of his death, the oldest of British geologists. While his scientific honors were numerous, the formal recognition by his Government of the value of his work, much of which had redounded greatly to the material advantage of England was tardy. It came to him in the form of a complimentary knighthood only on the New Year's day before his death in the following June, when he was not able, on account of feeble health, to accept it in person from her Majesty. Till 1872 Dr. Prestwich curiously combined the two occupations of wine merchant and geologist. His business took him frequently to France, and while there he sought and improved the opportunities he found to make geological studies of the districts he visited; and it is told of him that his friends used to like to go geologizing with him on the other side of the Channel, "as his walks generally ended in the pleasant château of some vine-grower."

JOSEPH PRESTWICH was born in Clapham, England, March 12, 1812, and died in Shoreham, Kent, June 23, 1896. He was taught at London and Paris, and in Dr. Valpy's Grammar School in Reading, and afterward studied at University College, Gower Street, London, where he gave special attention to chemistry and natural philosophy under Prof. Edward Turner and Dr. Dionysius Lardner. There also his attention was first drawn to geology and mineralogy, which were among the subjects in Turner's course. After he went into business he continued to devote all the leisure he could command to the study of geology, first as a means of relaxation and afterward on account of the scientific interest he took in it.

He began publishing scientific papers in 1835, when he was about twenty-three years old, his first, on the Ichthyolites of Gamrie, Banffshire, Scotland, having been printed in the Transactions of the Geological Society of that year, and some of his earlier papers on the Coalbrookdale Coal Field being of the same period. Other papers followed in the Quarterly Journal of the Geographical Society on Structure and Organic Remains of the Tertiary Beds of the London and Hampshire Basin, in which many now fully accepted facts of geological sequence and relations were first established. In these

researches he paid special attention to the lithological changes of the strata and to the fossils. In consideration of this earlier work he was awarded the Wollaston medal by the Geological Society.

Having acquired some familiarity with the geology of France by his former residence as a student and his frequent business there, Mr. Prestwich, in the course of the studies which resulted in the rearrangement of the Tertiary formations, carried his explorations across the Channel to the corresponding formations of France and Belgium, for the purpose of determining the correlation of the strata. In the course of these investigations, at the suggestion of Dr. Hugh Falconer, and in company with Sir John Evans, he examined the valley gravels containing flint implements—works of man—associated with the remains of extinct animals, the discovery of which in the valley of the Somme had been announced by M. Boucher de Perthes without attracting special attention. The finds made here could be compared with the somewhat similar discoveries made in England in Kent's Cavern by McEnery and in Brixham Cave in 1858. All these evidences of man's antiquity, together with others subsequently found in England, were studied by Prestwich and Sir John Evans, with the result of fully establishing the contemporaneous existence of man with other Pleistocene mammals. The question of the duration of man's existence upon the earth thus became a subject of lively discussion, which still continues. The theory of man's extreme antiquity, as indicated by these remains, which Mr. Prestwich was inclined to embrace at the time, and which he was among the first to promulgate in England afterward, underwent a process of modification in his mind, and he was disposed in his later works to reduce considerably the estimates he made then. In recognition of his work as one of the pioneers in establishing the geological antiquity of man, the Royal Society in 1865 awarded him the Royal medal.

As Dr. Prestwich grew older he paid more and more attention to economic geology, and finally became one of the most eminent authorities in that branch. His earlier studies on Coalbrookdale and the Tertiary strata seem, in the light of after developments, to have been preparatory, though unconsciously so, for such a career. A lecture on the geology of Clapham—The Ground Beneath Us—delivered about forty years ago to a local society, and his publication on the water-bearing strata of the country around London, were in that direction. The former work "has stood the tests of time remarkably well," and the latter, first published in 1851, has become a standard, and has lately been reissued with appendices. He was engaged upon the Royal Commission on Metropolitan Water Supply and upon the Royal Coal Commission, to the reports of which he

contributed valuable papers, one of them embodying the conclusion that the coal fields under the Secondary rocks of the south and south-east of England might extend from Somersetshire to the neighborhood of Folkestone, which has been confirmed by borings at Dover.

Dr. Prestwich retired from business in 1872, and in 1874 became professor of geology at Oxford. He continued his researches with his accustomed activity, and enriched the literature of geology from year to year with numerous valuable and original contributions, in the form of papers and addresses to learned societies, in connection with which his name constantly appears, and of books which are indispensable to the thorough student of the science.

Dr. Prestwich's annual address as president of the Geological Society in 1872 gives an admirable statement of the purposes of geological research with reference to the advent of man, and further on of its practical applications to the questions of water supply and coal. Among the theoretical problems that were then occupying the attention of geologists of all nations, the speaker said, were the phenomena connected with the prevalence of great and exceptional cold immediately preceding our time, the first dim appearance of man, his association with a race of great extinct mammalia belonging to a cold climate, the persistent zoölogical characteristics of man as contrasted with the variable animal types presented in geological time, the search for connecting links, and the measure of man's antiquity. Allied to these were the great questions relating to the forms of the continents—the elevation of the land, the origin of valleys and plains, and all that prepared the globe for the advent of man. Further, geology dealt with the requirements of civilized man, "showing him the best way of providing for many of his wants, and guiding him in the search for much that is necessary for his welfare. The questions of water supply, of building materials, of metalliferous veins, of iron and coal supply, and of surface soils all come under this head and constitute a scarcely less important although a more special branch of our science than the paleontological questions connected with the life of past periods, or than the great theoretical problems relating to physical and cosmical phenomena." Proceeding to consider the geological questions connected with water supply, the author suggested that the site of a spring or the presence of a stream determined probably the first settlements of savage man; and his civilized descendants, until the last few years, equally depended upon like conditions. These conditions were connected with the rainfall and with the distribution of the permeable and impermeable strata forming the surface of the country. Under ordinary circumstances few large towns had arisen except where a localized water supply was easily accessible, where

the catchment basin controlling the volume of the rivers was large, and where permeable strata prevailed. Thus it was with London, and the extension of that city had worked along in those directions where water was got with the best facility. The second part of the address related to the work of the Royal Commission to examine into the coal fields and the coal supply, under which Dr. Prestwich was charged with the study of the districts covered by the later Secondary and the Tertiary strata, with the special object of inquiring "into the probability of finding coal under the Permian, new red sandstone, and other incumbent strata. The discussion of this subject implied a survey of the coal fields of England, France, and Belgium, and the possible connection through strata underlying the formations named. Several regions were indicated where trials for coal might be made, which it was admitted, however, might be attended with considerable uncertainty. But whether successful or not as to coal, such trials near London could hardly fail of some important results; for it was "possible that the lower greensands would at some spots be reached, so that the inestimable additional benefit of a large and steady supply of pure water might also be obtained, and with proper care to prevent interference might be maintained for all time."

Commending Dr. Prestwich's investigation of the sources of the water supply of London, and the presentation of the results in his book on that subject—"a masterpiece of minute observation and close and accurate reasoning"—Prof. J. W. Judd observed that the geologist could point to the work "with pardonable pride as affording convincing proof that his science has now acquired a character for exactness analogous to that which is justly regarded as the crowning attribute of astronomy." His predictions as to the finding of coal underneath the Secondary rocks across the kingdom were likewise justified in the results of borings made near Dover.

An important practical application of Dr. Prestwich's investigations of the geology of the English Channel, not anticipated when they were begun, was illustrated in his report on the subject to the Institution of Civil Engineers, presented in December, 1874. This report was described by Nature as being a most excellent example of the indispensability of thorough scientific research as a basis for the useful arts, and of the way in which the highest practical results unwittingly follow from such investigations—made in abstract inquiry, the only end of which was thorough knowledge of the subject in all its scientific aspects and relations. This study of the strata underlying the Channel—an almost perfect example of close and careful reasoning on physical facts—was now brought forward to enlighten the projectors of a tunnel between England and France

as to the nature of the material on which they would have to work; but Dr. Prestwich had distinctly stated that the various formations were considered "irrespective of their relative merits in any other than a geological point of view." His plan had been to discuss carefully all the strata underlying the Channel, from the London clay down to the Palæozoic series, and deduce his conclusions as to the fitness of each formation for being pierced by a tunnel. The investigations on which the paper was founded were mostly undertaken from no practical point of view and before a Channel tunnel was thought of.

Dr. Prestwich's inaugural address as professor at the University of Oxford, in January, 1895, was on the Past and Future Work of Geology. We had no reason to suppose, he held, that during the greater part of the geological periods life in one form or another was not as prolific, or nearly so, in the British areas as at the present day. We might thus form some conception of how little relatively, though much really, we had so far discovered, and of how much yet remained to be done before we could re-establish the lands and seas of each successive period, with their full and significant populations. This we could not hope ever to succeed in accomplishing fully, for decay had been too quick and the rock entombment too much out of our reach ever to yield up all the varieties of past life; but, although the limits of the horizon might never be reached, the field could be vastly extended; each segment of that semicircle might be prolonged we knew not how far; and it was in this extension—this filling up the blanks in the life existing in each particular period—that one great work of the future lay. The speaker then considered two objections which had been urged against what had been called the cataclysmic theory in opposition to the uniformitarian theory—both terms characterized as objectionable in their exaggeration: one, that we required forces other than those which we see in operation; and the other that it was unnecessarily sought in that theory to do by violent means what could be equally well effected by time. The question raised in this theory is not, however, as to the nature of the force, but as to its energy; not a question of necessity one way or another, but of interpretation, of dynamics and not of time; and we can not attempt the introduction of time in explanations of problems the real difficulties of which were thereby more often passed over than solved. Time might and must be used as without limits; there was no reason why any attempt should be made either to extend or control it; but while there was no need for frugality, there was no reason in prodigality. After all, it would be found that, whichever theory was adopted, the need would not be very difficult. The mountain range, for the gradual

elevation of which one would ask one hundred thousand years, the other might require for its more sudden elevation a force which had taken the same number of years to accumulate its energies.

Discussing in the Geological Society in 1889 the distribution and probable age of some palæolithic flint implements, Professor Prestwich maintained that the removal of the material observed indicated the existence of agents of greater force than those operating under the present river *régime*. This closed up the time required for the completion of the great physical phenomena, though the author's inquiry tended to carry us further back geologically than was usually admitted.

In a paper read at the British Association in 1881 on the causes of volcanic action, Professor Prestwich presented objections to the generally accepted theory of Scrope that eruptions are a phenomenon of steam, and held that water, instead of being a primary was only a secondary cause of them—the primary cause being the rolling up of the lava in consequence of pressure due to a slight contraction of the earth's crust. The contact of this fluid lava with the water stored in the crevices is followed by a flush of steam, and this by an influx of water from underlying strata. These are converted into steam and expelled, and the exhausted strata serve as a channel for the influx of sea water into the volcano. A point is finally reached when by the cessation of the shocks and excessive drainage the flow of lava is effected quietly. A paper on Regional Metamorphism, read to the Royal Society in 1885, presented a theory that there exists, in the compression and motion of the strata which have always accompanied the upheaval of mountain chains, a true cause for the development of an amount of heat sufficient to produce one form of metamorphosis—a form which can affect only particular regions—and he would, therefore, in order to distinguish it from contact and normal metamorphism, designate it as regional metamorphism.

Some of Professor Prestwich's later views respecting the Glacial period were presented at a meeting of the Geological Society in May, 1887, when, after showing how the discoveries in the valley of the Somme and elsewhere, twenty-eight years before, had led geologists who had previously been disposed to restrict the age of man to exaggerate the period during which the human race had existed, he proceeded to discuss the views of Dr. Croll on the date of the Glacial period. In view of the recent observations in Greenland of Professor Helland, Mr. Steenstrup, and Dr. Rink, showing that the movement of ice in large quantities was much more rapid, and consequently the denudation produced was much greater than had formerly been supposed, he was disposed to limit the duration of the Glacial epoch to from fifteen to twenty thousand years, in-

cluding in the estimate the time in which the cold was increasing, or Preglacial time, and that during which it was diminishing, or Postglacial time. Details were given to show that the estimate of one foot on an average being removed from the surface by denudation in six thousand years, on which estimate the hypothesis that eighty thousand years had elapsed since the Glacial epoch was founded, was insufficient, as a somewhat heavier rainfall and the disintegrating effects of frost would produce far more rapid denudation. It was incredible that man should have remained physically unchanged during so long a period. At the same time, evidence that had been brought forward of the occurrence of human relics in Preglacial times had led the author to change his views as to the age of the high-level gravels in the Somme, Seine, Thames, and Avon Valleys, and he was now disposed to assign these beds to the early part of the Glacial epoch, when the ice sheet was advancing. This advance drove the men who then inhabited western Europe to localities which were not covered with ice. Man must, however, have occupied the country but a short time before the land was overwhelmed by the ice sheet. The close of the Glacial epoch, or the final melting of the ice sheet, might have taken place between eight and ten thousand years ago.

His latest and most matured views on this subject, agreeing substantially with these expressions, were embodied in his book, *Geology: Chemical, Physical, and Practical*, which was published in 1886 and 1888. In these volumes he gave more positive expression to the view which had been for some time assuming shape with geologists, and the acceptance of which had been made imperative by the results of geological surveys in America, that, while the great time divisions of geology may be of almost universal application, the smaller breaks in continuity, which are of frequent occurrence in all areas, are subject to constant differences of extent and value. Consequently, in filling up the details of the several geographical areas, each one is found to have its own local stamp, and possesses its own special terms, some knowledge of which is as essential to the geologist as the language of a country is to the traveler, if he would pass through it with profit.

In the preface to this work Professor Prestwich gave a clearer definition of his attitude toward the different schools of geological thought, observing that the doctrine of non-uniformity must not be confounded with reliance on catastrophes, and that it does not involve any questions respecting uniformity of law, but only those respecting uniformity of action. "I myself," he says, "have long been led to conclude that the phenomena of geology, so far from showing uniformity of action in all time, present an unceasing series of

changes dependent upon the circumstances of the time; and that while the laws of chemistry and physics are unchangeable and as permanent as the universe itself, the exhibition of the consequences of those laws in their operation on the earth has been, as new conditions and new combinations successively arose in the course of its long geological history, one of constant variation in degree and intensity of action."

In a lecture at the Victoria Institute in 1894, and in his book, published in 1895, on *Certain Phenomena belonging to the Close of the Last Geological Period and on their Bearing upon the Tradition of the Flood*, Professor Prestwich presented various phenomena which had come under his observation during long years of geological research throughout Europe and the coasts of the Mediterranean as "only explicable upon the hypothesis of a widespread and short submergence of continental dimensions, followed by early re-elevation; and this hypothesis," he added, "satisfies all the important conditions of the problem."

It will be observed that Professor Prestwich occupied a kind of independent position as a geologist, identified especially with no school, but forming substantially a school by himself. His publications, therefore, often embodied views different from the conclusions which his fellow-geologists had reached; or, to paraphrase an expression of his own, while they were all generally of one opinion as to the main facts of geology, in respect to the explanation of many of those facts they held very divergent opinions. This fact gave name and character to his last book—*Collected Papers on Some Controverted Questions of Geology*—which was published in 1875. It contained six essays, the first of which was devoted to the clear definition of the author's attitude with respect to the doctrine of uniformity, and the others were in criticism of the astronomical theory of Glacial epochs; the character, age, and make of the flint implements of the chalk plateau of Kent; the agency of water in volcanic eruptions; the thickness and mobility of the earth's crust; and underground temperatures. While these articles were all controversial, the book, as Professor Judd well said in reviewing it, "might fairly be cited as an example of the spirit in which scientific discussions ought to be carried out. No geologist who takes up this work but will find cherished ideas reasoned against or pet notions boldly assailed. But from beginning to end of the volume he will find that no word has been written which is calculated to give pain to the most sensitive opponent." In a similar spirit he exhorted the International Geological Congress in 1888: "Let us try to avoid that error of congresses—of arrogating an infallibility which is little in accord with the progress of science."

Nature, reviewing Professor Prestwich's book on geology in 1886, characterized him as the acknowledged master of British geology, of whom it might be safely affirmed that no living geologist had contributed in a greater degree to the advance of science by his important original researches.

Sir Joseph Lister, speaking in the Royal Society of his death, said that in him "we have lost about the last link that remained which connected geologists of the present day with the founders of the science in the first half of the century. To him we are indebted not only for the first comprehensive classification of the Tertiary beds of this country, to which he assigned the names by which they will henceforth be universally known, but also for their connection with the strata of the Paris basin. To him also is due the credit of having been the first to establish the authenticity of the remains of human workmanship found in the drift deposits of the valley of the Somme, and of thus having laid secure foundations on which arguments as to the extreme antiquity of man upon the earth may be based. In France his name is known and respected as much as in England, and it would be hard to say how much of the advance in geological knowledge during the last sixty years was not due to his unremitted labors, which extended over the whole of that period."

Professor Prestwich retired from the professorship at Oxford in 1888, and spent the rest of his life at his country home in Shoreham, working till almost his last day with undiminished activity. The list of his papers in the catalogue of the Royal Society includes seventy-seven titles, to say nothing of his contributions to other societies and journals. He was elected a fellow of the Royal Society in 1853; was appointed its vice-president in 1870; was president of the Geological Society in 1870; obtained the Wollaston medal of the Geological Society in 1849, and the Royal medal of the Royal Society in 1865; was president of the International Geological Congress in 1888; and was correspondent of the Institute of France, and foreign member of the Accademia dei Lincei, Rome, the Imperial Geological Institute of Vienna, the Royal Academy of Brussels, the American Philosophical Society, and other learned bodies.

THE London Spectator recently had a story of a dog that could understand a telephonic message, and now has another of a little fox terrier which, when the family are from home, goes to stay with one of the workmen, three miles away. When the people return, they send word to the mill directing that "Donovan" be told of it. He invariably arrives in the afternoon. He is quite happy and contented at the workman's till he is told of the return of his master and mistress, but after that nothing will keep him from the house.

Editor's Table.

THE SCIENTIFIC ADVANCE.

AS the nineteenth century draws to its close there is no slackening in that onward march of scientific discovery and invention which has been its chief characteristic. Far from it, discovery and invention seem to be proceeding with ever-increasing rapidity; it is as if a fountain had been opened which, far from showing signs of exhaustion with lapse of time, gained in volume and force from year to year. Whether a pause will ever come is a question which many would be disposed to answer in the negative. It seems impossible that Nature, now that we have discovered the true method of interrogating her, should not go on revealing herself to us with greater and greater fullness. Without speculating, however, too deeply on the future, we may affirm that at present the scientific movement is at its maximum of vigor and productiveness.

It is astonishing to look back and see the strides that have been made in eighty or ninety years. In the beginning of the century there were stationary steam engines, and a few crude attempts were being made in the direction of steam navigation; but as yet the locomotive was a thing unthought of. To-day marine navigation has taken the form we see in the giant vessels that ply between this country and Europe and the first-class battle ships of the world's great navies, with their triple-expansion engines, their wonderfully perfected boilers, their twin screws, and their infinitely multiplied appliances for safety and efficiency.

At the beginning of the century electricity was a curious study, giv-

ing only slight promise of any useful practical applications. It had not advanced beyond the frictional machine, the Leyden jar, and the voltaic pile. The telegraph was as yet undreamed of, and the telephone and the dynamo utterly unimaginable developments. Had any one dared to conceive that signals could be made to pass in a second of time between Europe and America he would have been considered a fit candidate for Bedlam; and certainly not less insane would have been considered the notion that a human voice could by any device make itself distinctly audible at a distance of five hundred or even a thousand miles. To-day these things are commonplaces, and men are beginning to grudge the trouble of putting up wires for the conveyance of the electric current, great authorities in the scientific world having told them that theoretically it ought to be possible to do without such crude appliances. What was a curious toy in the beginning of the century is the jack-of-all-work at its close, or, in other words, the most widely available form of force in the modern world. What steam can not do, owing to the difficulty, on the one hand, of generating it locally, and, on the other, of conveying it to any great distance, electricity, which is capable of infinite subdivision and of distribution from a relatively distant center, stands ready to undertake.

We have only to look around us to see the innumerable wonders that science in its practical applications has wrought, and to be impressed by the beneficence of its operations. The electric light in our streets and the familiar trolley car constitute ad-

ditions to human well-being and enjoyment the value of which it would be difficult to estimate, while the telephone has almost revolutionized the industrial and commercial life of cities and towns. Electro-chemistry, again, and photography are two arts the influence of which is at once widespread and penetrating. The former dissociates the elements, isolating those we wish to isolate and leading others to form new and desirable combinations. It has produced what is virtually a new article of commerce in the metal aluminium, previously a rare and expensive product, and in a thousand ways has transformed or modified industrial processes. What photography is to the present age it would take a considerable treatise to set forth. The bookmaker, the traveler, the astronomer, the physician, the analyst, the architect, the biologist, the police agent, the engineer, the microscopist, the military man, the artist, and the representatives of a hundred other crafts and professions would all have to contribute to the tale. By photography we can record successive moments in the impact of a cannon ball and analyze the life history of a lightning flash; we pierce the abysmal depths of space and catch the faintly trembling rays of bodies that no telescope has the power to reveal.

With the general advance of science the physician's art has gained a wonderful enlargement of its resources. The mighty hunter of to-day is not he who bags big game in the African forest or the Indian jungle, but he who, following in the steps of Pasteur and Koch, tracks the pathogenic microbe to its lair and studies to render it innocuous. When anything nowadays goes wrong with the physical organism, the man of scientific mind is disposed to exclaim—parodying a cele-

brated saying—"Cherchez le microbe!" Already a very considerable knowledge and mastery have been gained of these extraordinary agents, so utterly unknown to the science of the past; and there is no reason to doubt that great conquests are yet to be won in this particular line of research. But other lines of investigation only less important in their bearing on the preservation of life and health have been opened up within the past generation. Of these scarcely any is more interesting than that which has led to the discovery of the "internal secretion" carried on by such organs as the pancreas, the thyroid gland, and the suprarenal capsules. "No one can suppose," said Professor Foster, in his recent address before the British Association, "that this feature of internal secretion is confined to the bodies mentioned; it needs no spirit of prophecy to foretell that the coming years will add to physiological science a large and long chapter, the first verses of which belong to the dozen years that have passed away."

If we pass over to the region of psychology, we find that there, too, a notable advance has been made both in methods and in results. Mind is being treated scientifically as something correlated in the most intimate manner with the body, and for all practical purposes a function of a certain kind of organized matter. The observations which have been made from this point of view are undoubtedly of the highest importance in the work of education, and intelligent teachers are daily making use of them to a greater or less extent in the practice of their profession. There is a vast amount of knowledge in the world to-day in regard to the laws governing the development of ideas and the acquisition of knowledge, and as to the specific differences between the child

mind and the adult mind, which did not exist when the century was young, and which would never have existed had not a better method—the outcome of physical investigations—been adopted in the study of mind. To this result the science of anthropology has contributed in no mean degree. To-day we study man not as an abstraction, not as a creature dogmatically proclaimed to be only “a little lower than the angels,” but as he has actually manifested himself historically, and is now manifesting himself, in the sum of his habits, aptitudes, passions, customs, superstitions, imaginations, and achievements. We are at last taking to heart the advice of the ancient oracle, “Know thyself!” We see our true selves mirrored in the life of the race to which we belong.

In view of the vast accumulations of knowledge by which our age has been enriched, and of all that has been done within the last few generations for the betterment of human life, it might seem idle and paradoxical to doubt that the future is full of the brightest promise for our race. We have no disposition to join the prophets of evil of whom the present day possesses not a few. It is well, however, to remember that there is a double aspect to almost every advance in knowledge and in the perfection of the arts. Every gain tends to the disuse of some portion of human faculty, and unless it calls other portions into a more than compensating activity there is really no resulting benefit, so far as the development of the individual is concerned, and there may even be a loss. It would take us too far to illustrate this in any detail; but it is quite evident that many useful inventions, such as improved means of transit, the telephone, etc., while they quicken the pace of life, do not prompt either to physical or to intellectual exer-

tion, and that the vast provision made to-day for the entertainment and amusement of the multitude has little educative value and may even tend to the injury of the reflective powers. Amid the ever-increasing multiplicity of luxuries and novelties of every kind that are spread before the people to tempt the outer senses, the needs of the inner man are apt to be thrust aside and forgotten. In the illustrated books that are prepared for children so much is exhibited to the eye that nothing is left to the imagination. It sometimes seems almost possible that the modern world might be choked by its own riches, and human faculty dwindle away amid the million inventions that have been introduced to render its exercise unnecessary.

Further than this there is a tendency, which we think is already beginning to be well defined, to effect a radical differentiation between those who are concerned in carrying on the work of the world as thinkers and inventors and those who are only concerned in using the improved appliances placed in their hands. Some of our readers will remember the horribly grim development suggested in Mr. H. G. Wells's fantastical romance, *The Time Machine*—a degraded humanity inhabiting an externally perfected world. Without taking seriously so horrible a possibility, what we seem to see is that the times call for very special efforts to spread the knowledge and culture which are the product of the age, so that the intellectual life of the whole mass of society may be quickened. The leaven of thought and knowledge should be so applied as to work everywhere; in order that, while there may still be leaders of thought moving in regions inaccessible to the multitude, there may at least be no considerable sections of society

sodden in ignorance, and living lives of children or savages amid the light of a scientific age.

THE USES OF EDUCATION.

WE fear that, with all the alleged improvements that are being introduced into the methods of education, the true end of education is being more and more lost sight of. The idea that education is essentially a preparation for money-making is, it seems to us, gradually taking complete possession of the popular consciousness. It is needless to say that this was not the ancient ideal. To-day we look upon arithmetic as indispensable for the earning of a living. Plato, as Oscar Browning remarks in his little book on Educational Theories, considered it "as the best spur to a sleepy and uninstructed spirit." Admitting that the modern view must be recognized, why should not the more elevated ancient view be recognized as well? But what child is made aware to-day that in studying arithmetic he is doing more than acquiring an instrument by which afterward money may be made? There is just as much need to rouse sleepy spirits now as there ever was; and there are more sleepy spirits than ever to be roused. We fear the arithmetic of the public schools is not doing as much to rouse them as might be desired, and the reason may partly be that the higher intellectual and moral uses of the study are not kept sufficiently in view.

In the Greek scheme of education "reading" (we quote from Mr. Browning) "was taught with the greatest pains; the utmost care was taken with the intonation of the voice and the articulation of the throat." If anything of the kind were proposed to-day, objection would at once be raised that such training of the ear

and vocal organs might be very useful, and pecuniarily profitable, to a youth who was going to be a professional elocutionist, but that for others it would be a waste of time. So with the study of modern languages: their utility is recognized in so far as they may be required for business purposes, and perhaps for actual use in foreign travel. That they may become a source of refined intellectual pleasure by extending one's survey of the development and differentiation of thought is, to say the least, not an everyday conception. Geography is, of course, regarded as an essentially commercial study, not as one that ought to liberalize the mind by removing ignorance in regard to foreign countries, and creating a sense of the kinship of the whole human race.

Even in our higher seats of learning the ultra-practical or technical view of the use of education more or less prevails. In an excellent article by Mr. Irving Babbitt, in a recent number of the *Atlantic Monthly*, we read that "one of the first things that struck M. Brunetière on coming into contact with our university life was the predominance of purely analytical scholarship—a predominance which he attributes to an excessive imitation of German models. He even agreed with the opinion expressed by one of the Harvard professors, that several of our great universities are in danger of degenerating into mere technical schools as a result of losing hold on the old humanistic ideal."

The humanistic ideal is founded on the old truth which, in a manner, we still profess to believe, that "the life is more than meat, and the body than raiment." According to that ideal, the business of education is to enable a human being to enter on full possession of all his faculties, in order that, so far as possible, he

may be perfect as a human being. A man or woman who has been truly educated according to this ideal is not dependent for his or her enjoyment of life on coarse pleasures or childish excitements. There are sources of happiness in the awakened intellectual and moral powers and the well-trained physical organism that are not exhausted even with advancing years. The question which educationists have to consider is whether it is not possible, without sacrificing in any degree whatever the just claims of practical life, still to uphold and make manifest that higher conception of education which existed in past times, and which is still cherished wherever liberal views of life prevail. If arithmetic, geography, grammar, the sciences, and languages are consciously used with a view to intellectual and moral results, that surely will not interfere with a subsequent "practical" use of the knowledge gained by the pursuit of those studies. If we are not mistaken, we see indications of a growing feeling that education in the higher sense to which we refer is not democratic. That is a point on which we are not prepared to pronounce an opinion; but certainly the education we should desire for any one in whom we felt an interest would not be one which left his whole higher nature out of the account.

PARENTAL NEGLECT AS A CAUSE OF
HOODLUMISM.

It may be doubted if ever in the history of this country complaints of lawlessness, particularly of that kind known as hoodlumism, were so bitter and so universal. The evil is not confined to the South, where the ravages of the civil war left a deep mark of demoralization, nor to the far West, where the rudeness of frontier life is no stimulant to virtue. Even in

the East, in New England, the home of Puritan order and virtue suffers from it. So serious and widespread has it become in towns still inhabited by the descendants of the stern men and women that fled from the vice and intolerance of the civil and ecclesiastical rulers of England that Prof. Charles Eliot Norton, at the dinner given to fellow-professors at Ashfield, Mass., a few weeks ago, was moved to sound the alarm, taking as his text the shocking murder of a woman at Shelburne Falls by a village ruffian of New England birth.

The address, startling but not sensational, has evoked very general discussion. It has stimulated the production of theories to account for this flood of lawlessness. One is the absence of proper police surveillance to restrain the disorderly instincts of the ruffian. Another is the absence of the civic virtue that compels people to take part in public affairs, and to see to it that life and property are protected. While both are doubtless worthy of consideration, neither of them goes to the root of the matter. We are still in the dark as to the reason of the absence of civic virtue and the presence of criminal instincts. Why, after all our elaborate legislative efforts to make people walk in the straight and narrow path, and to provide them with all the educational advantages that money can buy, is it true, in the bitter words of Alphonse Karr, that "*plus ça change, plus c'est la même chose*"? In other words, why have all our efforts to promote civilization resulted only in the revival of barbarism?

We believe that the chief of the Massachusetts police has hit upon one of the most potent causes of this deplorable state of affairs. "The root of the trouble," he said, when asked his opinion of Professor Norton's address, "lies in the fact that so many parents are lax in bringing up

their children. . . . In proof of this, look at the streets of our cities after nightfall, swarming with rude, unmannerly boys taking their first lessons in hoodlumism. Parents fail to realize their responsibility toward their children." When this is the case, what more can we expect than the prevalence of lawlessness in town as well as city, in the East as well as the West, in the North as well as the South? Children that have not been subjected to the firm but gentle discipline of the home, that have not been taught by their parents the habits of order, decency, and virtue, are not likely to grow up with a sense of their duty to themselves or to their fellows. They are almost certain to grow up as loafers, or corruptionists, or as citizens indifferent to the demoralization around them. It is still as true as it ever was in the old copy book that as the twig is bent so is the tree inclined.

But why are parents lax in bringing up their children? Why do they fail to realize their responsibility toward their offspring? Nothing is more important in the world than parenthood; it is the basis of society and civilization. Nothing is better fitted to give pleasure. We believe that some German pessimist has condemned it on the ground that as long as it prevails the desire to live will never be extinguished. When men and women lose their interest in the world itself, they cling to it because of their interest in their children; and when their children have grown up, it is still maintained by their interest in their grandchildren, ever hoping to see realized in the lives of the new generation the dreams of happiness and fame that were never realized in their own. However cynical and depressing this may be, it has unquestionably much of truth. The survival of those children whose parents took the best care of them

has given birth to a set of powerful feelings that can be gratified only through parenthood. These feelings, sacred above all others, respond to efforts to protect the child from harm, to develop its intellect, to cultivate its manners, to intensify its affections—in a word, to make it a good man or woman, capable and high-minded.

Yet how recklessly and amazingly have parents strayed from the path that will lead them to the greatest happiness vouchsafed to any human being! How ceaseless have been the efforts to convince them that there is another way for them to attain this bliss and at the same time hasten the advent of the millennium! So successful have these efforts been that it is now expected that the public schools shall do all the work that Nature herself designed for more fit and tender hands. Only last summer the Superintendent of Public Education of the State of New York set forth very elaborately the new theory of parenthood, or, rather, revived the old Greek theory with slight modifications. "The State," he said, "has a right to demand from the schools that children be trained, first of all, to a thorough mastery of the studies in the elementary course. . . . But with these studies," he continued, demanding the impossible, "should be taught courtesy of manner, politeness of speech, refinement of thought, and genuine culture of life. The State has the right to expect also that pupils from the beginning of their course be imbued with the spirit of honesty, with the love of truth and purity, with integrity of thought and action. . . . While it is never the province of the State to teach religious truth after the distinctive tenets of any form of belief, it is emphatically the duty of the State to see that children are taught the highest and purest morality."

Is this not an assumption by the State of most, if not all, the duties that belong to parents? Who better than they can teach "courtesy of manner, politeness of speech, refinement of thought, and genuine culture of life"? Who better than they can inspire them "with the spirit of honesty, with the love of truth and purity, with integrity of thought and action"? Who better than they can see to it that "children are taught the highest and purest morality"? The association of parents with a child is constant and extends over many years; that of any public-school teacher, intermittent and very brief. There are the ties of an affection that bind them to it and impel it to obey them that do not exist, except feebly, between it and the teacher. These ties are of the utmost importance. Nothing should ever be said or done to weaken them. On the contrary, everything should be said and done to strengthen them for use in the guidance of the footsteps during impressionable years. It was by the pursuit of this course that Alphonse Daudet was enabled to enjoy the complete and loving confidence of his children as long as they remained under the parental roof, and to shape their lives in a way that, when they passed from his wise and gentle direction, there was no tend-

ency to revert to barbarism, such as we see to-day everywhere in the United States.

If an end is to be put to this evil, the preaching and practice of the vicious doctrines that pervade the address of Superintendent Skinner must cease. When any work for the betterment of the moral and physical welfare of children is to be undertaken, it must not be thrown upon the State, which has come to consist of nothing more than the politicians, whose violation of all the virtues he enumerates with such eloquence is the theme of countless philippics in pulpit, press, and conversation; it must be assumed by parents, who alone have the power to inculcate those virtues with any degree of success. While we do not believe with Professor Norton that there should be a restoration of Puritan discipline with the theology left out, we do believe that there must be a restoration of Puritan responsibility toward children, tempered with love and unfailing patience. It will lead parents to assume a vastly larger share in the work of education than they now do, thus strengthening the ties of affection so potent for moral control, and making it impossible for children to desire or parents to allow them to go on the streets to take "their first lessons in hoodlumism."

Scientific Literature.

SPECIAL BOOKS.

THE SCIENTIFIC SPIRIT IN KIPLING'S WORK.

THE collected edition of Mr. Kipling's prose and verse* published by the Messrs. Scribner presents the successful execution of a singularly felicitous idea. The *Soldiers Three* stories, which first made known the appearance of a new genius, were scattered in various legitimate and pirated editions like the tales of social and of native life in India. Even the *Jungle Books*

* The Works of Rudyard Kipling. Outward Bound Edition. Large 12mo. Uncut, gilt top. Illustrated by Lockwood Kipling. Volumes I to X. New York: Charles Scribner's Sons.

lacked the last tale—perhaps not the last—for In the Rukh appeared in *Many Inventions*, published by D. Appleton and Company in 1893. For the first time, therefore, we now have a properly classified exhibition of the wealth which Mr. Kipling has added to imaginative literature. The titles of the volumes under the present systematic arrangement are *Plain Tales from the Hills*, *Soldiers Three* and *Military Tales* (two volumes), *In Black and White*, *The Phantom Rickshaw*, *Under the Deodars* and *Other Stories*, *The Jungle Books*, *The Light that Failed*, and *The Naulakha*. The illustrations have been photographed from reliefs modeled in clay by Mr. Kipling's father. The light paper, handsome type, with its firm, clear impression, the generous margins, and dignified binding are reasons for congratulations to publisher and reader alike.

If this were the place for purely literary comment upon Mr. Kipling's splendid gifts much might be written of the tremendous power of his best expression, the resonance of his song, his quick insight into motives, and his control of a gamut which might be deemed to run from Hood to Poe, since his imagination, power of sympathy, and his quick humor thrill us, or move us to laughter, at his will. But all this the reading world has recognized. Very little, however, has been said of Mr. Kipling's application, possibly more or less unconscious, of scientific principles in his work. It is quite unnecessary to explain that Mr. Kipling is not an ethnologist because he differentiates the Hindu, Sikh, or Afghan so consistently, or because in all his work he expresses more forcibly than any other writer the characteristics which have made England a great imperial power. He is not an alienist because of *The Madness of Private Ortheris*, or *The Man who Was*, or *In the Matter of a Private*, or *The Phantom Rickshaw*, or *The Disturber of Traffic*, or *At the End of the Passage*, and yet a professional alienist might well accept his diagnosis of certain phases of mental aberration, his description of the effects of certain hallucinations and illusions, and his description of severe mental shock and aphasia in *The Man who would be King*, and elsewhere. He is not a physiologist, but his exactness in indicating the physiological effects of strong emotions—witness *Mulvaney in battle*—is another indication of the quality of his analytic observation. To cite a very different instance, in a preface to *Wee Willie Winkle* Mr. Kipling has illustrated his attitude toward children in saying: "If a mere man keeps very quiet and humbles himself properly, and refrains from talking down to his superiors, the children will sometimes be good to him, and let him see what they think about the world." This, as Mr. Gosse has said, suggests the collector of exact data, the naturalist lying quietly in the grass and noting the habits of birds and animals.

The wonderful *Jungle Stories* have added a new character to fiction in *Mowgli*, yet if we judge the other characters by our special standard Mr. Kipling's power of getting at the roots of things—of reasoning to causes—is perhaps less apparent in these stories for a reason not far to seek. Certain familiar motives shown in mating and in jealousy, in the father's place as provider and in the mother's care for her young, in instincts of self-defense and revenge, and in quasi-tribal organization and leadership would naturally lend themselves to a writer's purposes. But while certain truthful characteristics are retained, the developed personification of Mr. Kipling's animal heroes takes them almost as much out of the field of exact observation as the animals of our own Indian mythology. The reason of

this is found in the very simple justification offered by the claims of art. Dr. Groos's *Play of Animals*, shortly to be published in English, is a very valuable example of the scientific attitude. That Mr. Kipling's literary treatment has been untrammelled is a cause for congratulations, unless we are to beg the question at the outset by relegating imagination to fairy tales pure and simple. Now, Mr. Kipling does not deal in fairy tales, but primarily with motives which are practical. When Shelley enshrined the skylark in literature he did not clip the wings of his song with an explanation that the skylark sometimes destroys crops in Germany. This fact would have been noted by Mr. Kipling, and in one way or another his imagination would have found a way of suggesting it in a purely literary form. This is an extreme case, but it illustrates fairly enough a mental curiosity, alertness, and keenness of perception which would have made a mark in laboratory work, let us say, if Mr. Kipling had been a student of science. The suggestion gains piquancy from the constant presence in Mr. Kipling's work of a quality diametrically opposed to this—the martial spirit, which is quite the reverse of the scientific. Mr. Kipling's earlier years of association with the British army in India have left an impress which will remain. In spite of the nobler motive of the magnificent *Recessional*, the ring of the sword is heard throughout the larger portion of his verse and prose, a note due to his intense vitality and personal force, as well as to the accentuated patriotism of the poet laureate of Greater Britain.

Patriotism, however, which we are assured is unscientific and merely a phase of selfishness, has nothing to do necessarily with another phase of Mr. Kipling's literary performance—his literary conquest of the new realm of applied science. From him we have learned that the locomotive engineer may be a more romantic figure than the mailed knight, and that the passing away of white sails has lessened in no degree the poetry of the sea. The central motive of our time is the application of science to industry, but it was left for Kipling to sing the song of steam in McAndrew's Hymn. One grows chary of the use of that time-honored phrase "a new note." There have been so many "new notes" which have died away into a silence never broken afterward. But if Mr. Kipling should write no more, he has already proclaimed the romance of machinery, the heroism of "earth's chosen men of strength," the significance of the deep-sea cables, "blind, white sea snakes," and he has expressed the appeal to the poet's imagination made by phases of invention, commerce, and manufacture, which have had hardly a superficial recognition heretofore. There are critics who quarrel with Mr. Kipling's liberal use of the nomenclature of marine engines and locomotives, but that is not a quarrel to be insisted upon. Possibly, like a student in the first flush of enthusiasm, he is unconsciously zealous to show that he does not "miscall technicalities," but "coupler flanges" and "spindle guides" by the score will not prevent such work from reducing the number of "damned ippjits" who whimper that "steam spoils romance at sea." Quite aside from purely literary quality, with which we are not primarily concerned in this place, Mr. Kipling's power of concentration, his application as a student, and his ability to master practical details are exhibited to a very striking degree in McAndrew's Hymn, in *The Ship that Found Herself*, in his long story *Captains Courageous*, and in his story No. 007, which appeared lately in *Scribner's Magazine*. We do not think that a story like the last furnishes the human interest

or the enjoyment found in the best of his Indian tales. The personification of the familiar locomotive or, for that matter, the horses in a Vermont pasture, inevitably comes, if not as an anachronism, at least as a wound to that desire for the possible which unconsciously guides adult readers of pure fiction. Nevertheless, all this treatment of applied science is, as we have said, the opening of a new territory, in which we believe Mr. Kipling will find many lasting additions to English song and also to English fiction. While a few exceptions have been taken to the correctness of his technical phrases—for example, by Mr. Cy Warman in his verses on No. 007—Mr. Kipling's accuracy is phenomenal. Noting this in the London Academy a year ago, a sailor remarked: "The secret of his success is that he always goes straight to the fountain head for his information. . . . His mind can best be compared in acquisitiveness to a sleepless octopus, always gathering in something with each of its tentacles." So far as his work in fiction is concerned, we think the human interest of the lives on an overinsured, unseaworthy tramp steamer will make a more direct appeal than the conversation of cylinders and piston rods, notwithstanding the usual moral. Like Cromwell's soldiers, Mr. Kipling believes in the moral law, the wrath of God, a stout arm, and a sharp sword. Like a Roundhead also, he feels at times a stern sense of judicial responsibility toward the quick and the dead, especially if they are Americans.

This brings us to one last point, barely to be touched upon, which is that Mr. Kipling's remarkable power of perception and analysis is not accompanied by a corresponding power of synthesis. This is quite at variance with the common judgment, but it may be illustrated by comparisons of sketches of individuals with the romantic passion of his devotion to the Empire, or, again, by a comparison of single types with the curious image which Mr. Kipling has evolved in *The American*—a poem which should have had as its logical complement some verses on the Jameson raid, the British war ships at Crete, and the Armenian atrocities. But this is a small matter, so far as we are concerned, and youthful tendencies to sweeping generalizations are commonly too unimportant to call for any other remedy than time. Mr. Kipling has so many qualities essential to a scientist that one is the more disposed to deprecate occasional broad assumptions and the influence of acid prejudices; but any limitation is suggested with reluctance when one writes of the young genius who within ten years has become the foremost active figure in the English literature of this day, the most sonorous singer of verses, and the most impressive story teller. We have yet to mark his arrival as a novelist. Meantime the perfectly appointed edition of the Messrs. Scribner is a necessity for those who would have their libraries include some of the best gifts which English letters have offered to the world—gifts from a young man of thirty-two, with his richest years yet before him.

In *The Present Evolution of Man*,* Mr. Reid discusses the question whether the struggle for existence has ceased with man. Dr. Moxon, whose declaration is quoted among those of other authors to furnish a text for the essay, affirms that it has, and that the conflict is now one against mere existence. The latter aspect of the question is not touched in the book. Dr. Moxon's attitude is treated as characteristic of that of the majority of

* *The Present Evolution of Man*. By G. Archdall Reid. London: Chapman & Hall. Pp. 870.

the general public, and also of the majority of medical men, who, "while observing the effects of disease on man the individual, have signally failed to observe its effects on man the species." While he accepts evolution in its widest and most absolute sense as a certainty, the author differs from the usual views, in that in his opinion acknowledged authorities have not recognized or have not laid sufficient stress on certain processes of evolution which appear to him of the greatest importance. The book is intended to lead up to the presentation of these processes, and is divisible into two parts, in the first of which the problem of evolution in general is briefly considered, with an attempt to penetrate somewhat deeper in certain directions than has hitherto been done, and in the second part the conclusions arrived at are applied to the problem of man's present evolution, with an endeavor to show that this evolution is proceeding in a direction hitherto altogether unexpected. The processes of evolution are supposed to be singly, inappreciably minute, and all as still going on—even spontaneous generation, which we do not discover, because the really earliest forms of life are beyond all devisable means of observation. The inheritance of acquired qualities as a factor of evolution is rejected, and the process is held solely dependent on the survival of the fittest. Yet the variations acquired by every normal individual have a magnitude and importance far beyond that which is commonly attributed to them by biologists. The present evolution of man, while development in bodies and brains is an element in it, is mainly an evolution against disease. The stage of evolution reached by European races is the result of a long process of selection against certain classes of diseases to which they have become comparatively proof. The natives of other regions into which European civilization is extending itself have this immunity yet to acquire. Hence the deadly influence of our civilization upon them when they are subjected to it. Other agencies which are the causes of the elimination of the unfit are the narcotics. The influence of these two classes of factors, and the nature and extent of the modifications affected by them in physical and mental conditions, are the subjects of the second part of the book.

GENERAL NOTICES.

To the American Lectures on the History of Religions, given under the direction of an association representing a number of co-operating institutions and local boards, Dr. *Daniel G. Brinton* has contributed a course on *Religions of Primitive Peoples*,* which were delivered during the winter of 1896-'97 at Boston, Brooklyn, Ithaca, New Haven, New York, Philadelphia, and Providence. By primitive peoples are meant those of the earliest stage of culture of which trustworthy information exists, while religion, hardly susceptible of a limited definition, is regarded as in some form or other universal

in the human race. The study, of which these lectures present the fruits, undertaken without bias or partisanship, but looking upon all religions alike "as more or less enlightened expressions of mental traits common to all mankind in every known age," is pursued by the historic, the comparative, and the psychologic methods. Laying down his postulates in the first lecture, Dr. Brinton discusses in the five succeeding lectures The Origin and Contents of Primitive Religions, Primitive Religious Expression—in the Word, in the Object, and in the Rite—and The Lines of Development in Primitive Religions. All the religions are regarded as unconsciously directing and impelling the mind toward the abstract stage, when the idea

* *Religions of Primitive Peoples*. By Daniel G. Brinton. New York: G. P. Putnam's Sons. Pp. 264. Price, \$1.50.

stands by itself as the recognized guide of conscious effort; when infinity or perfection is no longer conceived in relation to a being or personality, but is still the loftiest motive and the deepest source of spiritual joy—a goal that may be still far away but is ultimately to be reached.

When we stroll along the road we see many things in plant and animal life to awaken curiosity and interest; but as we are generally intent upon other matters and do not usually know precisely what they are and how they are related to one another, we pass them with little notice and straightway forget about them. Mr. F. Schuyler Mathews has undertaken, in his *Familiar Features of the Roadside*,* to awaken a more genuine and lasting interest in these objects and to furnish information that will help us to identify and distinguish them, and to become, as it were, more personally acquainted with them. "It might be possible," he says, "to find a wider field for the study of Nature than the highway, but in many respects certainly not a better one, for if we keep on traveling we will have eventually seen and heard about everything that is worth seeing and hearing in the wide world." This may be strongly expressed, but there is certainly vastly more than we suspect to be found by sharp eyes and keenly tuned ears on the mountain tops and the seashore, and in the bogs, forests, meadows, pastures, glens, hills, lakes, rivers, and brooks by which the road will lead us if we follow it far enough. The author describes such of these things as he has observed and as came to his mind, and arranges and classifies them according to the seasons and their associations. Thus he tells of the flowers we may find early and late and the families to which they belong, the singers of the meadow and woodland and with musical and unmusical voices, not letting the birds monopolize attention at the expense of the frogs and squirrels; and of the colors on mountain, meadow, and woodland, and of the colors of autumn. In the first chapter, telling of a spring walk, all the flowers we are likely to meet are described, and more

kinds of singing amphibians are differentiated than one without special information would suppose existed. The illustrations are fitting and excellent, and the bird notes and other intonations are written in music.

The main purpose of this volume* is to present the results of recent archaeological investigations in Tennessee, and more especially the district in which the so called mound builders' remains are found. The original volume was published several years ago, and its complete sale, combined with the recent interesting and important discoveries, have led the author to the preparation of this revised and somewhat extended edition. The subject is presented in a series of historical and ethnological studies, the material being found principally in the cists or box-shaped graves built of stone slabs which have been so extensively exhumed of recent years in Tennessee. In accordance with a common custom among savages at a certain stage of development, these prehistoric people placed vessels containing provisions and various utensils in the graves for the use of the deceased on his journey to the spirit land. The remains, thus sealed up and protected from the waste of time, are now exhumed in a very perfect state of preservation. They tell the story of ancient domestic life in the Cumberland and Tennessee Valleys with remarkable exactness, and hence are of great ethnologic interest. Mr. Thruston describes them with much detail. There are about three hundred and sixty fairly good illustrations.

When Mr. Ward's book† first appeared in 1883, you might probably have made the rounds of the colleges without ever hearing the word sociology, and if you did it was only some grammarian growling about the liberties which ignorance was forever taking with etymology. But now, on the contrary, the word and its congeners are almost as om-

* The Antiquities of Tennessee and the Adjacent States. By Gates P. Thruston. Cincinnati: The Robert Clarke Company. Pp. 369. Illustrated. Second edition.

† Dynamic Sociology, or Applied Social Science, as Based upon Static Sociology and the Less Complex Sciences. By Lester F. Ward, A.M. In two volumes; second edition. New York: D. Appleton and Company. Pp. 706 and 690. Price, \$5.

* Familiar Features of the Roadside: The Flowers, Shrubs, Birds, and Insects. New York: D. Appleton and Company. Pp. 269. Price, \$1.75.

nipresent as the barrel organ. At the forefront in bringing about this popularization of sociology has been Mr. Ward's book itself. It is now an important and largely patronized department in nearly every college and university in the country, has numerous periodicals devoted entirely to its treatment, and has even made a place for itself in the daily papers. The subject is of interest to every one, and is of such a nature that a little careful study amply repays the student both in new knowledge and as mental training. This increase of general interest in sociology has made a new edition of Mr. Ward's book necessary. As the work was given a long and appreciative review in these pages in June, 1883, we shall simply refer readers to that issue for further information.

*The Student's Manual of Physics** has been adapted by the author, Mr. Leroy C. Cooley, for use in the combined method of teaching by oral instruction, text-book study, and laboratory work. It contains much less material than other elementary text books for purely illustrative work, and much more of that which is necessary for systematic and successful quantitative study. Throughout the book a laboratory course accompanies the text, the experiments being described at the close of the numbered sections and set in different type. By cross references and a systematic notation attention is directed to the facts and principles that have been already studied and are involved in the study of the subject in hand. The author insists as an important feature on the pains he has taken to preserve continuity in the discussions and a smooth flow in the transitions from one subject to another, also on his attempt to impart clear-cut conceptions of physical quantities and avoid ambiguities. The explanations are clear and lucid, and the manner of the book is modern.

The Natural Elementary Geography of Mr. Jacques W. Redway† represents the latest methods in the study and teaching of

the science, and is composed in accordance with the recommendations of the Committee of Fifteen. The central idea of the treatment pursued in it is man, his history, customs, industries, and geographical relations; and the different countries are described according as they relate to man. In the beginning the pupil is started from home and is taken eastward to the Atlantic and then westward to the Pacific, while the characteristic features of the country he passes over and the settlements are insisted upon and made plain. He is then taken across the ocean and to other countries, and they are described nearly in the order of the closeness of their relations with us. For the United States the old arbitrary divisions based on location are subordinated to divisions according to elevation, climate, and industries. In Europe the divisions are according to racial lines. The maps are physical and political, so adjusted as to scale as to give correct ideas of the comparative areas of countries. The illustrations are all intended to instruct and are excellent.

This little work,* one of a series entitled Home-Reading Books, is rather difficult to place. It is in the first place as fascinating as a fairy tale, and in the second so instructive as to be repellent to the mind of the average youth. It is an attempt to interest the child in a class of life which abounds in every pond and stream—namely, the protozoa. Each of these apparently characterless little masses of protoplasm, with far less intelligence than the average clam, assumes under the treatment of Miss Bayliss a personality almost as distinct as that of our human neighbors. In Chapter I, which is devoted to rhizopods, the leading member is the amœba, introduced as the "slowest thing on earth." The whiplashers are visited in the second chapter. Then come the ciliata, succeeded by an amusing chapter on protozoan philosophy. There are eleven chapters, the last of which, *The Greatest Joke of All*, might have been appropriately labeled *As Others See Us*, being an examination under the microscope of the human youth conducted by the

* *Physics: The Student's Manual for the Study Room and Laboratory.* By Leroy C. Cooley, Ph. D. American Book Company. Pp. 448.

† *Natural Elementary Geography.* By Jacques W. Redway. American Book Company. Pp. 144. Price, 60 cents.

* In Brook and Bayou, or Life in Still Waters. By Clara Kern Bayliss. Illustrated. New York: D. Appleton and Company. Pp. 175. Price, 60 cents.

various creatures which the previous chapters have thus studied. The book is well printed and illustrated, and, while there are some lapses into technical phraseology, the text is in the main readily comprehensible by a child of ten or twelve.

A work by Dr. *C. Christiansen*, of Copenhagen, on the *Elements of Theoretical Physics*, has been translated by Prof. *W. F. Magie*, of Princeton (Macmillan, \$3.25). Although with ill-judged modesty labeled "Elements," it is an advanced text-book presenting the mathematical side of the subject exclusively and using the calculus throughout. The translator deems it valuable because it presents the fundamental principles of theoretical physics, and develops them so far as to bring the reader in touch with much of the new work that is being done in the subject. While not in every respect exhaustive, he regards it as stimulating and informing, and as furnishing a view of the whole field that will facilitate the reader's progress in special parts of it. He says further that there has been a need of such a book in which the various branches of the subject are developed in connection with one another and in a consistent notation.

The lectures delivered at the Princeton sesquicentennial celebration by Prof. *A. A. W. Huxley* on *The Descent of the Primates* have reached us in book form (Scribner's, \$1). While the subject is a highly technical one, and the treatment is necessarily such as to place the argument beyond the reach of any one but a specialist, the investigation has so important a bearing on the evolutionary origin of the human race that it has been deemed worthy of permanent form. The contention is, briefly, that the usual way of looking upon the three subdivisions—the duckbills, the marsupials, and the placental mammals—as a real and historical sequence is not in accordance with their true relationships. This is not, as the author says, a new idea, but was originated some years ago by Huxley. The author has derived his material chiefly from a study of the embryology of the tarsius, a curious and rare form hitherto ranked with the lemuroids.

The Mechanical Arts Simplified, by *D. B. Dixon* (Laird & Lee, Chicago), is one of those so-called handbooks of useful informa-

tion. It seems to contain a great deal of accurate information, in the shape of tables and formulæ, for the mechanic and the mechanical engineer, but it is largely a compilation of unrelated and isolated facts which have little practical value for the average mechanic, and which are of slight value, at best, in such a book, because of the difficulty of finding them. For instance, on page 258 we have first a table giving the weights of thirteen metals, followed by some tables on flour and corn mills extending through page 259; page 260 discusses the miner's inch and the flow of water through vertical rectangular openings, and page 261 gives us, among other things, a table of mortality statistics based on American experience, the date when the first steamboat plied the Hudson, when the first sawmaker's anvil was brought to America, when kerosene was first used for lighting purposes, when the first lucifer match was made, and the date of the appearance of the first newspaper advertisement.

A list of *Reagents and Reactions known by the Names of their Authors*, based on the collection of *A. Schneider*, has been issued by the Pharmaceutical Review Publishing Company, of Milwaukee. It is of interest chiefly to pharmacists and analysts (price, 50 cents).

A little volume on *Les Insectes nuisibles*, by *A. Acloué*, that has recently come to us is devoted to giving the habits and mode of development of noxious insects, and the best known means of combating these creatures. The book contains sixty-seven cuts. (F. Alcan, Paris, paper, 60 centimes; cloth, 1 fr.)

In *English Local Government of To-day* (Vol. IX, No. 1, Columbia Studies in Economics) *M. R. Maltbie* gives us a careful economic discussion of the relations between central and local government. The purposes of the inquiry are thus set forth in the introduction: "First, to show the growth and historical development of the English system of central and administrative control; second, to outline its present legal and practical status; and, third, to ascertain the actual results obtained through it." The author arrives at the conclusion that local self-government, pure and simple, has been proved inefficient, and that it is possible to estab-

lish a system of central administrative control which does not destroy local autonomy, but which secures efficient administration while not encroaching upon those ideas and principles for which Anglican institutions have so long been prized.

Papers and notes on *The Genesis and Matrix of the Diamond* (Longmans, Green & Co.), by Prof. H. C. Lewis, is a technical account of the geological formation in which the Kimberley and adjacent diamonds occur. The basis of the work was two lectures, delivered before the British Association in 1886 and 1887. They have been deemed of enough importance to deserve permanency, and, under the editorship of Prof. T. G. Bowney, have been combined with some isolated notes on the occurrence of diamonds elsewhere into the present volume. There are thirty-five illustrations.

In *Sex Worship* (published by the author, Clifford Howard) we have an attempt to

treat this rather difficult topic in a popular way. Up to this time, as the author says, the subject has been confined to a small class of scholars and investigators, whose works are difficult to obtain, both because of their rarity and costliness. The present volume has no value to the scholar because of its superficiality, and is, we think, little suited to general circulation because of its subject.

No. 6 of the Field Columbian Museum Zoölogical Series is a *List of Mammals from Somali Land*, obtained by the museum's East African expedition. There are about fifty pages of text and twenty-five full-page plates. The material has been arranged by the curator of the museum, D. G. Elliot. The expedition was a much-needed one, and because of the rapid disappearance of the large wild game in Africa and the information and specimens obtained will in a very few years be the only means of studying many of these animals.

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Fragments of Science.

Unselfish Science.—One of the happiest features of the opening session of the American Association at Detroit was the welcoming address of ex-Senator Thomas W. Palmer. Amid the general scramble for money power which characterizes the present age, he said, "it is gratifying to know that there is an increasing number of men and women who, ignoring the common objects of ambition, have devoted themselves to and are diligent in the unselfish pursuit of truth." These men and women find in the phenomena of Nature history related with accuracy and predictions certain to be verified. "Formerly it was considered that there was a conflict between science and religion. Let us hope that that day has long been passed, and that the more enlightened public recognizes that religion has to do with the spiritual nature of man and science with physical phenomena." The speaker had been seeking a definition of science, and conceived as the most satisfactory one to his mind "the classification of phenomena to the end that principles may be established and declared from which may be deduced rules of action that shall be applicable to particular cases.

When did science first originate? Back of the dawn of history, when primeval man, emerging from the shelter of the cave before he had even built him a hut, commenced to apply the force of Nature to his use. . . . How did science originate? By extended observations, experience, and comparison. The first savage who played in the water with his reed as a baby does with a straw, blowing and sucking it, gave the first illustration of hydraulics. The little savage playing in the woods at the ancient game of seesaw would find that the heaviest boy would have to sit nearest the center, and this would give the first suggestion of the lever."

The Beginning of Photography.—A bust of Daguerre, the inventor of the pioneer of all photographic processes, was dedicated at Bry-sur-Marne, where he died, June 27th, in the presence of representatives of the French Government. The idea of fixing by some chemical process the pictures which were formed on the screen of the camera obscura had been entertained, and many persons had tried to discover the art before

Daguerre was born; but it was left for him, with the co-operation of Niepce de Saint-Victor, to accomplish the object. Daguerre was not a chemist or physicist, but a decorative painter, who when business was slack was not above painting theater scenes and panoramas, which had been introduced into France by our Fulton; and he derived much profit from a diorama which he exhibited with Bouton from 1822 to 1830. While thus occupied he met Niepce, a man of scientific knowledge but none of business. He told Daguerre of some experiments he had made in heliography, and a proposal of partnership followed in 1826. Niepce, however, never reached a practical result, but died in 1833, leaving a son who continued his researches. Daguerre in the meantime had acquired some ideas in chemistry and knew all Niepce's secrets, but was not able to use them alone. He formed another alliance with the son. In 1839 this younger Niepce called Daguerre into his laboratory and showed him a complete image fixed upon a silvered plate—the first daguerreotype. From this the photographic art has been developed by a succession of brilliant discoveries. No exact mathematical award of the merit of the invention can be made between the partners, but they must receive each an undivided share alike; but Daguerre has certainly reaped the wider fame. The discovery created a great sensation. In order that it might be placed immediately at the service of the public, the French Chambers, on motion of Arago, awarded pensions of six thousand francs to Daguerre and four thousand francs to Niepce as the price for which it should be made free.

The Career of a Floating Bog.—Floating bogs are very prominent features in some of the lakes of Minnesota. They have not, however, been found very abundant by Mr. Conway MacMillan in the Lake of the Woods. As developed, Mr. MacMillan says, the floating bog comes to have some characters peculiarly its own, due to its moving about in the water and its removal from any particular point of attachment. A redistribution of its component plants takes place, and the peripheral areas are specialized from the central. A group of plants may be distinguished at the water's edge, able to

bear the lapping of the waves and enjoying the higher illumination. At the center of the island shrubs, or even small trees, may become established. Drifting about from one shore to another, touching at different points, and frequently exposed to strong winds while in transit, the bog becomes a resting place for numerous varieties of light seeds. It is, further, sometimes colonized by the plants of the region near which it may be situated. Thus the number of species of plants established upon it tends to rise; and floating bogs of long standing are scenes of very sharp struggle for existence among a considerable number of alien plants. The undulating movement communicated to the bog when exposed to wave action loosens somewhat its tangled network of roots and decayed organic substances, so that the nature of its soil is modified. The presence of the lake water underneath every part of the formation keeps it cool and moist beyond what is possible in an attached morass. These various conditions are sufficient to give the floating bog a population distinctively its own. It often happens that after floating for a season or two, or even for a number of years, a bog is carried into some angle or cove from which it does not readily escape, and may become anchored there. It is then subjected to the influences of the new environment, and is modified accordingly.

Limits of the Power of Hearing.—Lord Rayleigh began a lecture at the Royal Institution on The Limits of Audition by observing that one of the latest determinations of the frequency of vibrations to which the ear is sensitive gave the lower limit as twenty-four complete vibrations a second, and the upper as about twenty thousand a second. These limits are, however, very ill-determined, because the matter depends largely on the vigor of the vibration and the individual ear. Old people do not hear high notes which are audible to young persons, and the speaker had reason to believe that babies hear notes which persons twenty or thirty years of age can not detect. Experiments on the extent of vibration necessary to audition were described, which appeared to show that a vibration having an amplitude expressed in centimetres by a fraction having eight for its

numerator and one, followed by eight ciphers, for its denominator could still affect the ear. To make a comparison with the limits of microscopic vision, the vibration that is just perceptible to the ear would have to be multiplied by one hundred before it could be seen by any possible microscope; or, put in another way, the sensitiveness of the ear is such that it could distinguish differences of pressure one hundred times less than the residual pressure of the best vacuum, which is to be measured in millionths or less of an atmosphere.

Early Traction Cables.—The first use of cables for transmitting power to a distance—telodynamic transmission—was made, according to Prof. W. Cauthorne Unwin, in 1850, at Lozelbach, Alsace, when some large factories which had been idle for nine years were started up again. The buildings were scattered at considerable distances apart, and there was only one steam engine. A steel band, working like an ordinary machine belt, was introduced for driving one of the factories about two hundred and fifty feet from the engine. It was mounted on pulleys a little more than six feet in diameter and making one hundred and twenty revolutions per minute, and was used for eighteen months, transmitting twelve horse power. On the suggestion of an English engineer, a wire-rope cable, a quarter of an inch in diameter, was then substituted for the band, while the same pulleys were used, with grooves turned in the rim to hold the cable—till after a few years they were replaced by pulleys of iron. A transmission to a distance of seven hundred and fifty feet was next arranged, with cables running on pulleys ten feet in diameter, at a speed of about fifty feet per second, and transmitting forty horse power, which, with pulleys at mid-distances, are still in use. The amount of work transmitted by a cable is proportionate to the amount of effectual tension in the cable and its speed. The strongest material should be used for the cables, and they should be run at the highest practicable speed. The largest cables which it appears practicable to use are about one inch in diameter. In order that the bending stress may not be excessive, the pulleys are of large diameter, usually from twelve to fifteen

feet. Gutta percha, soft wood, and leather have been used for the throat of the pulley, on which the rope runs. The greatest speed at which it is practicable to carry the rope depends upon the centrifugal tension of the pulley, and is usually about one hundred feet per second. With pulleys from three hundred to five hundred feet apart, a one-inch rope will transmit about three hundred and thirty horse power.

Dahlias and "Cactus" Dahlias.—The first dahlias seen in Europe grew in the Botanical Gardens at Madrid, in 1789, from seeds sent from Mexico. The flowers were "single" and had eight rays disposed in a circle around the yellow disk. The first double forms were produced in Louvain, Holland, in 1814, after three years' work. All members of the composite family that have been through the process of doubling and have enough flexibility to entitle them to extended cultivation exhibit, Mr. Wilhelm Miller says in the Bulletin of the Cornell University Experiment Station, at least three strongly marked tendencies—to reproduce single forms; to develop large globular flowers that are completely double; and a tendency toward what are called pompons. The single varieties are the most natural and the easiest to produce and fix, while the large-flowering and pompon varieties are to a greater extent products of art. The large-flowering varieties are the hardest to produce and the most uncertain. These somewhat conventional and artificial forms are still supposed to be essential to the nature of the dahlia; but they are not. In the evolution of the dahlia too much attention has been paid to color and not enough to form. The twelve hundred varieties catalogued in 1841 "were too much like twelve hundred variously painted balls of two sizes. No new or original idea found place in the evolution of the dahlia till 1873, when the first "cactus" dahlia, *Juarezii*, was produced. Instead of short, stiff, artificially formed rays, it has loose, flat rays with pointed or twisted ends, and the peculiar red that is associated with the cactus. Other colors have since been developed, which are not that of the cactus, and that part of the name of the class is no longer appropriate. Only the rays have been cultivated, while

the disk flowers have been neglected. In the chrysanthemums, by cultivating both, a bewildering variety of forms have been obtained. It may be many years before the disk flowers of the single dahlia can be drawn out to so great a length as in some of the chrysanthemums; "but it can be done, and there is no reason in the nature of things why we should not have a race of dahlias analogous to the anemone-flowered chrysanthemums." The chrysanthemumlike forms are already some of the best we have.

Animals' Stores.—A writer on Animals in *Famine* observes in the *London Spectator* that if we examine the stores made by most of the vegetable-eating animals that lay by a "famine fund," we shall find "a rather curious similarity in the food commonly used by them. They nearly all live on vegetable substances in a concentrated form—natural food lozenges, which are very easily stored away. There is a great difference, for example, between the bulk of nutriment eaten in the form of grass by a rabbit and the same amount of substance in the 'special preparation' in the kernel of a nut, or the stone of a peach, or the bulb of a crocus, off which a squirrel makes a meal. Nearly all the storing animals eat 'concentrated food,' whether it be beans or grain, hoarded by the hamster, or nuts and hard fruits by the squirrel, nut-hatch, and possibly some of the jays. But there is one vegetable-eating animal whose food is neither concentrated nor easy to move. On the contrary, it is obtained with great labor in the first instance, and stored with no less toil after it is procured. The beaver lives during the winter on the bark of trees. As it is not safe, and is often impossible, for the animal to leave the water when the ice has formed, it stores these branches under water, cutting them into lengths, dragging them below the surface, and fixing them down to the bottom with stones and mud. This is more difficult work than gathering hay."

Ancient Man in the Delaware Valley.—

At a joint session of the Geological and Anthropological Sections of the American Association, held for the discussion of the Evidences of the Antiquity of Man in the Delaware Valley, Professor Putnam gave a

general review of the whole subject and of the statements made by Dr. Abbott in 1883 of the finding of supposed palæolithic implements in the gravels near Trenton, N. J. The more important of the facts brought up have already been noticed in the *Monthly*. During the investigation of the region under Professor Putnam's supervision, in which every foot of the tract—half a mile long and one hundred feet wide—was dug over, photographs were taken of the chipped stones as they were found *in situ* in the sand and clayey deposits. These photographs and the specimens themselves were exhibited to the sections. While himself convinced that the argillite implements found in this site were the work of men anterior to the Indians, he had invited other archaeologists and geologists to visit the place and investigate for themselves. Several had done so, and had reached conclusions similar to his and Dr. Abbott's as to the antiquity of the argillite remains. Papers were read by G. N. Knapp, H. B. Kummel, Prof. Thomas Wilson, Dr. H. C. Mercer, and Prof. R. D. Salisbury substantially in agreement with these views. Prof. G. F. Wright held that the formation of the clay indicated the action of water, thus further attesting the great antiquity of the find. Prof. W. H. Holmes held that the implements simply indicated the beginning of the Indian in that region. He thought the sand was piled up by the action of the winds, but did not touch upon the presence of the clay.

Ingenuity in Bow Making.—To establish the point that environment is not the cause but the occasion of industries, and that the true source of all arts must be sought in the ingenious human creature, Prof. O. T. Mason cites the fact that the withholding or the concealment of gifts by Nature acts as a stimulus to ingenuity. "Take, for example, the bow. There are regions where the wood for this implement is perfect, as in South America or the hard-wood forests of the eastern United States. Here the very embarrassment of riches leads men to be satisfied with a very poorly made bow. Now, the characteristics of a good bow are rigidity and elasticity. When our ingenious friend the Indian climbed the eastern slopes of the Rocky Mountains away from the hard-

wood forests, he invoked the mammals to yield the sinew from the leg or the scapula, and with this he glued an elastic back upon his poor implement or united two or three horns so as to get his effect, the middle piece giving the columnar resistance, the wings putting to flight the arrow. By and by you approach the hyperborean man and ask him how he is going to have a bow. It is true that he has only brittle driftwood, that glue will not hold in his cold and damp clime, and that materials for arrows are scarce. The result of this is the sinew-backed bow and the harpoon arrow, together the most complicated and ingenious device ever contrived by a savage mind. The bow wood has one virtue, that of rigidity. By an ingenious wrapping of hundreds of feet of fine sinew thread or braid from end to end along the back with half hitches on the limbs at every danger point the virtue of elasticity is added, and you have one of the most quickly responsive implements in the world. The arrow is quite as cleverly conceived."

Value of Pure Mathematics.—The presidential address of Prof. A. R. Forsyth in the Section of Mathematical and Physical Science of the British Association related to the value of the study of pure mathematics aside from the consideration of any applications that may be made of it. By some, mathematical study is regarded as useful only as it affords means for arriving at results connected with one or other of the branches of natural philosophy; by others, as it may possibly apply to practical issues. To the former class of critics the author cited instances in which the utilitarian bias in the progress of knowledge has not been the best stimulus, or in the long run the most effective guide toward securing results; to the others he maintained that mathematical students are justified in not accepting practical issues as the sole guide by the consideration that such issues widen from year to year and can not be foreseen. Moreover, if such a principle was adopted many an investigation undertaken at the time for its intrinsic interest would be cast aside unconsidered, because it did not satisfy an external test that really had nothing to do with the case, and might change its form of application from time to time. Among instances in which the purely

mathematical discovery preceded the practical application and was not an elucidation or an explanation of observed phenomena, are cited the principles of conic sections, known to the Greeks two thousand years before Kepler and Newton found in them the solution of the universe; the methods of analysis by the application of which the discovery of the planet Neptune was attained; the reasoning on the properties of wave-surfaces by the use of which Sir William Hamilton inferred the existence of conical refraction; and the theory of functions, in which the purely mathematical interest was deemed supreme, which has found application in the investigations of Lagrange and others on the construction of maps; in investigations on discontinuous two-dimensional fluid motion in hydrodynamics; in the dynamics of a rotating heavy body, in various questions in electrostatics, and in some of the recent advances in physical astronomy. In the field of natural philosophy mathematics will furnish more effective assistance if in its systematic development its course can freely pass beyond the ever-shifting domain of use and application.

Curiosities of Zoölogy.—Prof. L. C. Miall observes, in his sectional address at the British Association, that zoölogists may justify their favorite studies on the ground that to know the structure and activities of a variety of animals enlarges our sense of the possibilities of life. Surely it must be good for the student of human physiology, to take one specialist as an example of the rest, that he should know of many ways in which the same functions can be discharged. Let him learn that there are starfishes whose nervous system lies on the outside of the body, and that in other animals it is generally found there during some stage of development; that in certain animals the circulation reverses its direction at frequent intervals; that there are animals with eyes on the back, on the shell, on limbs and limb-like dependencies, in the brain cavity, or on the edge of a protective fold of skin; that there are not only eyes of many kinds with lenses, but eyes on the principle of the pin-hole camera without lens at all (nautilus), and of every lower grade down to mere pigment spots; that auditory organs may be

borne upon the legs (insects) or the tail; that they may be deeply sunk in the body and yet have no inlets for the vibrations of the sonorous medium (many aquatic animals). It is well that we should know of animals with two tails or with two bodies permanently united; of other animals developed within a larva which lives for a considerable time after the adult has detached itself (some starfishes and nemertines); of animals which lay two or three kinds of eggs; of eggs which produce two (an earthworm) or even eight embryos apiece; of males which live parasitically on the female, or even undergo their transformations, as many as eighteen at a time, in her gullet; and of female animals which are mere bags of eggs. The more the naturalist knows of such strange deviations from the familiar course of things the better will he be prepared to reason about what he sees, and the safer will he be against the perversions of hasty conjecture.

The Life of the Toad.—From a study of the toad, by Mr. A. H. Kirkland, we learn that in this region it usually emerges from its hibernating quarters during April. Cold weather retards its movements, but on warm days in the spring the toads make their way to the ponds and stagnant pools. Mating is begun as soon as the water is reached, or even before, and in a few days the long slimy "ropes" of eggs deposited by the female may be found in the pools. The eggs are nearly black, and rapidly increase in size. In two weeks the young tadpoles are clearly outlined, and in three or four weeks the eggs hatch. The vegetable detritus of the pond bottoms and the slime and algae attached to sticks, planks, etc., seem to be the common food of the tadpole. Warm weather favors the growth of the tadpoles, and usually the young toads are fully developed, leave the water, and spread over the fields. At this stage they are extremely sensitive to heat, and secrete themselves under leaves, stones, rubbish, etc., during the day; but after a hard shower they come out by thousands. Observations of the toad's feeding show that eleven per cent of its food is composed of insects and spiders beneficial or indirectly helpful to man, and eighty per cent of insects and other animals directly injurious to

cultivated crops or in other ways obnoxious to man. Their stomachs can accommodate enormous quantities of food, and one will consume in twenty-four hours an amount equal to that required to fill the stomach four times. It is estimated that in one season a toad might destroy cutworms which would otherwise have damaged crops to the extent of \$19.88. The toad thus renders conspicuous service to farmers, and gardeners and greenhouse owners could make it of special use. As there are laws for the protection of insectivorous birds, why should there not be as stringent legislation against the destruction of toads? If merit of service rendered to man be the standard by which legislation is determined, the toad presents a record which will compare favorably with that of any insectivorous bird.

Magnitude of Mexican Ruins.—Of the ruins of ancient cities in Mexico which Mr. W. H. Holmes has examined and described in his publications respecting them in a comprehensive scientific manner, none, perhaps, are more remarkable and extensive as a whole than those near the city of Oaxaca. Many of the important works here are found on mountain tops, "and one soon comes to recognize the notched profiles of the ridges and peaks that border the valley as being due to the strangely directed enterprise of the ancient inhabitants. The feeling of surprise induced by this discovery is followed by one of amazement as the real nature of the work dawns upon the mind. As the explorer climbs the slopes and picks his way from summit to summit, he is fairly dazed by the vast array of pyramids and terraces, which not only crown the heights, but overspread the steep slopes, destroying traces of natural contour and making the mountains actual works of art." Climbing one of the larger pyramids of the group on the summit of Monte Alban, the author obtained a magnificent panorama of the mountain and the surrounding valleys and ranges. "Turning to the north, the view along the crest was bewildering in the extreme. The crest of Alban, one fourth of a mile wide and extending nearly a mile to the north, lay spread out at my feet. The surface was not covered with scattered and obscure piles of ruins, as I had expected, but the whole mountain had

been remodeled by the hand of man until not a trace of natural contour remained. There was a vast system of level courts inclosed by successive terraces and bordered by pyramids on pyramids. Even the sides of the mountain descended in a succession of terraces." But San Juan Teotihuacan, twenty-five miles northeast of the capital, in the magnitude of its remains and in the evidence the site furnishes of population and antiquity, "easily stands at the head of the ancient cities of Mexico. It lacks the well-preserved, sculpture decorated buildings found elsewhere in Mexico and Central America"; . . . but if the entire mass of the ruined structures of either Chichen, Uxmal, or Mitla was to be heaped up in a single mound it would hardly surpass the great Pyramid of the Sun alone in bulk, and the whole bulk of the Teotihuacan remains is many times that of its chief pyramid."

Significance of the Totem.—The Import of the Totem was the subject of a paper read by Miss Alice C. Fletcher before the Anthropological Section of the American Association. The Omahas have two totems, the social and the individual. In the course of the ceremonial attendant upon reaching puberty the young man fasts till he falls into a trance. If he sees or hears anything while in that condition, that becomes the medium through which he obtains supernatural power. He must seek and slay the animal he saw and preserve some part of it. This memento is his totem. Its efficacy is based on the Omaha's belief in the continuity of life, which links the visible to the invisible, binds the living to the dead, and keeps unbroken the thread of life running through all things, making it impossible for the part and the entirety to be dissociated. Thus one man could gain power over another by obtaining a lock of his hair. The totem opens a means of communication between man and the various agencies of his environment, but it can not transcend the power of its particular species; consequently all totems are not equally potent. Men who see the bear are liable to be wounded in battle. Winged forms give the faculty of looking into the future and controlling coming events, while thunder gives ability to control the elements and authority to conduct certain

religious rites. The simplest form of the social totem is in the religious societies, the structure of which is based upon the grouping together of men who have received similar visions. Applied to the gens, or tribal body, the object of the totem was to teach the people the knowledge and duties of kindred, and one of the most important of these duties was the maintenance of the union of the tribe. The gentile totem gave no immediate hold upon the supernatural, as did the individual totem to its possessor. Outside of certain rites it served solely as a mark of kinship, and its connection with the supernatural was manifest only in its punishment of violations of the taboo. Its inculcation was that the individual belonged to a definite kinship group, from which he could never sever himself without incurring supernatural punishment.

The Moon and the Sabbath.—The Rev. R. J. Floody presented to the American Association the results of ten years' research into the origin of the week and holy day among primitive peoples. He found that they were widespread among the nations of the ancient world from very early times. Each of these peoples is assumed to have independently originated the Sabbath and not to have received it second hand from other tribes. To account for the unanimity in observing this universal custom among so many races, we must look for its source in some phenomenon of Nature common to all. The prominence of seven as a sacred number among ancient peoples is due to the moon. Each lunation has four phases or quarters, averaging about seven days apiece. Nature worship was the earliest form of worship among primitive peoples, and the moon took precedence among objects of Nature. When the new phase of the moon appeared, men worshiped it, showing their honor and respect by sacrifices and then a feast. They would naturally rest from labor most of the time to give attention to the feasts. Work on the sacred day was considered inauspicious. This early week was the rough and ready reckoning of men devoid of the use of astronomical instruments. The holy day was not the seventh day of time, but the seventh day of the moon. The difficulty of getting the exact number of days of the lunar week

to fit into the lunar month led to the substitution in some of the nations of three weeks of ten days each. The author substantiated his theory by citations from the literature and traditions of many peoples.

Hindu Godlings.—The godlings or inferior deities commonly worshiped by the masses of the Hindus, and described in Mr. W. Crooke's book on the Popular Religion and Folklore of Northern India, are of very different character from the exalted conceptions of divinity described in the Vedas and known to the select among high-caste Brahmans. They are very numerous, and are described under the five headings of the godlings of Nature, heroic and village godlings, the godlings of disease, the sainted dead, and the malevolent dead. The godlings of Nature include the sun, the moon, the demon of the moon's eclipse, the rainbow, the Milky Way—known also as the pathway of the snake or the course of the heavenly Ganges—Mother Earth, thunder and lightning, the sacred junctions of rivers, sacred wells and lakes, hot springs, waterfalls, sacred mountains, hail and whirlwind, *aérolites*, etc. The great rivers, especially the Jumna and the Ganges, stand very high in the list of benevolent Nature godlings. The heroic village godlings form a numerous class; and there seems to be confusion between some of them and some Mohammedan saints in high repute. The current from a ventilator placed at the tomb of one of these saints to furnish fresh air to the pilgrims was believed by them to be his holy breath, and they went round to worship it. The godlings of disease are mostly goddesses, and are forms of Kali, the goddess of death. There is a goddess of

cholera, and one of smallpox, but none of the plague; whence it is inferred that that disease is new to India. The belief in the good luck of horseshoes is common in India, and so is the custom of throwing rice after brides.

Classification of Fibers.—While engaged in cataloguing the fibers of the world, Charles Richard Dodge found that a better classification was needed, and has published the scheme which he devised. Besides the popular understanding of the term fiber as relating to those forms of filamentous substance that can be spun and woven or twisted into cordage, he would include under it rougher substances that are plaited. In his classification two groups of fibers are recognized, based on cell structure. The first group includes fibers with fibro-vascular structure, embracing three groups: bark fibers, derived from the inner bark of exogenous plants; woody fibers, comprising barked stems or twigs, roots, the split wood of exogenous plants, and wood-pulp; and structural fibers, derived from the structural system of endogenous plants. The second group—fibers of simple cellular structure—comprises surface fibers, including the down or hairs surrounding exogenous seeds or their envelopes; the hairlike growth found on stems, leaves, and buds; fibrous material produced in the form of epidermal strips from the leaves of palms, etc.; and false fibrous material—mosses and leaves used for packing, and certain fungous growths. It is the consideration of these useful native fibers that makes it possible to enumerate a thousand species of fibrous plants, while the world's commercial fibers would hardly reach a total of fifty species.

MINOR PARAGRAPHS.

IN his sectional address on the Labor Question before the British Association, Prof. E. C. K. Gonner drew a parallel between the present age and the Renaissance. Analogies between the present period and that of the fifteenth and sixteenth centuries offer themselves in different ways. Then, as now, the time was one of discovery, and the discoveries of either period have had effects both destructive and constructive—destroying opinions resting on certain narrow conceptions of

the sphere of life, but giving opportunity for new ideas and vaster conceptions. Each period was a time of a new learning, and in both knowledge has been sought in a return from theories rigid and out of consonance with life to life itself and the facts of life. In the sphere of religion and morals the likeness is strangely evident. In both cases there was failure to distinguish between the fleeting form and the abiding reality, and there were particular tendencies, largely by

way of result, affecting morals and conduct. In the fifteenth century, as now, these latter were not so much in the direction of that coarseness which somehow or other is often called immorality, but rather in that of a lack of moral discrimination and will. The mediæval Renaissance found its salvation in the emphasis of individuality, alike in religion, in the state, and in industrial activity. At the present we seem tending in another direction, and seeking a positive moral guidance in an enlarged conception of social duty and solidarity; and the position which employed labor occupies in regard to them is sufficient to insure it sympathetic attention.

Morocco, by reason of its geographical position and the peculiar distribution of its mountains and valleys, enjoys, according to Mr. Charles Rolleston, the varieties of climate between those of the north of Scotland and the plains of India. Its productions are also varied, and under a good administration would be valuable. With extortionate taxation and the insecurity of property industries languish. The sugar cane was introduced by the Arabs during the middle ages, but the profitable nature of the crop exposed the owners to oppression, and the former rich plantations have become things of the past. Most of the country is well adapted to horticulture, but the almost prohibitory export duties prevent a trade which might go far toward supplying the fruit markets of Europe with oranges, lemons, dates, peaches, plums, apricots, grapes, figs, pomegranates, mulberries, and olives. The empire is also rich in minerals and in agricultural products. With all these munificent resources Morocco has fallen into decadence, simply on account of the vice of its political administration, which does not fulfill a single function, duty, or responsibility of the government, but is generally mischievous.

THE serpent symbol was described by the Rev. S. D. Peet, in a paper read in the American Association, as prevalent all over this continent. It appears in effigies in Canada, Ohio, Illinois, and Minnesota. Certain myths among the Iroquois and Algonkins represent the serpent as coming out of the water, fascinating men and turning them into serpents, and taking them below the water—thus reminding one of the temp-

tation. While in these and other myths of those nations the serpent is the source of evil, in Nicaragua and Yucatan it is the source of good. It is in reality the symbol of the rain cloud, and the crops and the seasons are dependent on its appearance. Instead of antagonizing the chief divinity, it seems to be sailing through the air, bearing that being on its back, or holding vases in its folds that empty water or rain upon the fields. In Nicaragua the serpent appears in sculpture, highly wrought and carved with great force. The sacred books of the Mayas have many representations of serpents. Even the hieroglyphics of the Mayas have serpents upon them, forming parts of the glyph. Among the Pueblos the serpent figured in a very interesting way in the ceremonies of the initiation of the youth.

In his characterizing of the Arctic Seas, Mr. J. Scott Keltie says that to the north of Europe and Asia we have the scattered groups of islands—Spitzbergen, Franz Josef Land, Novaya Zemlya, and the New Siberian Islands. To the north of America we have an immense archipelago the actual extent of which is unknown. It may be that the islands of this archipelago are continued far to the north; if so, they would form convenient stages for the work of a well-equipped expedition. It may be that they do not go much farther than we find them on our maps. Whatever be the case, it is important to the interests of science that this section of the Polar Sea be examined; that as high a latitude as possible be attained; and that soundings be made to discover whether the deep ocean extends all round the pole.

AN ocellated lizard which M. Charles Dreaux kept for thirteen years grew to be nearly eighteen inches long and to weigh almost half a pound. Having come from a mild region, it was supposed not to be in the habit of hibernating, and was kept during the first winter in a warm room. It suffered thereby from the violation of its customs, and, while it continued active, did not eat, and was reduced, when spring came, to a pitiful condition. Kept in a cool room in after winters, it was regularly dormant from the latter part of October till about the middle of March, or between four and five months. Its winter slumbers were not,

however, entirely continuous, but it changed its place frequently and sometimes came out to drink. It lost between a ninth and a twelfth of its weight; molted late in May or early in June, sometimes also in July, but rarely twice a year. It is very tame and very curious. It was probably two years old when captured, and was consequently, at the beginning of 1897, about fifteen; and it shows signs of age in its diminishing agility, growth, and appetite.

Of the stations in the international series for cloud observations, Prof. Frank H. Bigelow said in the American Association that the United States has fourteen. The object of observations at all these points is to determine the actual circulation of the atmosphere at different cloud levels. Heretofore indications have been worked out from the surface of the ground, where the circulation is much distorted. The action of storms is usually strongest two or three miles above the surface. The author criticised the conclusions of German meteorologists, who have worked on theories by mathematical processes, as being ideal and not conforming to actual conditions found in Nature. He showed by maps how storms run around rather in the upper isotherms than on the ground. The form of these lines is largely determined by the relation of land and ocean. The result is that the upper currents, which would run smoothly otherwise, become distorted by their passage over the land. Storms are abnormal parts of the general circulation, and have the force of that circulation behind them.

In his experiments in photography from kites at Enlaure, near Labruguière, France, M. Arthur Batut observed that when he flew his kite with a north wind, though it was a strong one, his kite kept its balance in the air without violent jerkings; while with wind from the south or southeast, unless it was extremely light, the kite dodged hither and thither and was extremely irregular in its movements, as if there were eddies in the air stratum. The north wind reached Enlaure after blowing over a plain country, with only gentle undulations; while the south and southeast winds came from over a broken country. Aëronauts who have suffered from caprices of the wind before reaching an area of calm in the atmosphere have sometimes

ascribed their trouble to eddies in the lower air strata occasioned by irregularities in the surface of the ground. The irregularities in the flying of the kite may have had a like origin.

Of the physical and mental training gathered—laboriously and somewhat wastefully, it may be—at the joiner's bench, in the fitting and turning shops, and the forge during the old course of mechanical engineering apprenticeship, Mr. G. F. Deacon expresses himself convinced that the kind of knowledge which comes of thoughtful chipping and filing and turning and forging, though only applied to a few of the materials with which in after-life the engineer has to deal, are quite as important to his future sense of rightness in constructive design as tables of density and strength. The use of such work is not merely to teach one the parts and combinations of any particular machine; to a still higher degree it is the insensible mastery of a much more subtle knowledge or mental power—the application of the senses of sight and touch and force, it may be of other senses also, to the determination of the nature of things.

AN interesting memoir was recently presented to the Paris Academy of Medicine by Dubousquet-Labordaire and Duchesne concerning a group of families at Saint-Ouen, an industrial district on the outskirts of Paris, which appear to have been immune from tuberculosis for many generations. The families are at present ninety-eight in number, and consist of five hundred and eleven persons. No cases of tuberculosis have occurred among them, as far back as the memory of the oldest inhabitant reaches. They are a farming people of excellent sanitary habits, and rarely or never mix either socially or by marriage with immigrants from other sections.

EVER since aluminum has been used in construction difficulties have arisen in soldering it. The following contribution to Nature by A. T. Stanton is of interest in this connection: If cadmium iodide be fused on an aluminum plate, decomposition of the salt occurs long before the melting point of the aluminum is reached. The result is generally the violent evolution of iodine vapor, and the formation of an alloy of cadmium and

aluminum on the surface of the metal. The addition to the cadmium iodide of the two chlorides of zinc and ammonium, previously fused together, results in a flux, which readily enables tin (or other soldering alloy) to unite perfectly with aluminum.

NOTES.

MR. VERNON HARCOURT has retired from the general secretaryship of the British Association, which he has held for fourteen years; and Prof. Roberts Austen, who has for some time assisted in the work, has been chosen to succeed him.

M. B. RENAULT, a French investigator, has long been working at the identification of fossil bacteria. The general results of his observations have recently been published. He believes them to have been coeval with the first appearance of organic life on the earth, the spherical form being earlier than the rodlike. He has found indications of their presence in bone, teeth, and scales, and also in vegetable tissues. The species are, as a rule, distinct from those at present in existence.

Few States, says Mr. John Gifford, in his report on the forestry of that State, "have been more thoroughly deforested than New Jersey. Just how to mitigate this evil without the expenditure of large sums of money and without infringing on private rights, or without adding to the expense of those who are already burdened with unprofitable land, is indeed a difficult problem on which there is great diversity of opinion. After a visit to several of the principal forest regions of Europe . . . the writer believes that great caution is necessary in this work, and that what is gained must come little by little until America has, after much experimentation, developed her own systems applicable to her varied climate, species, soils, and demands." The first and most important steps are the prevention of conflagrations and the construction of roads in forest regions.

THE method of the computation of the Chinese calendar is described by Paul d'Enjoy in the *Bulletins de la Société d'Anthropologie*, 1896, p. 52: "Every year is named by a combination of two words according to a fixed rule, and the special combination is supposed to indicate the fortunes of the year. The year 1896 was the period of the external hearth and the monkey; that is a time of dangers from abroad, which must be met by cunning and dexterity. In 1897 the Chinese enter into calmer times, under the auspices of the internal hearth and the chicken. Next year the combination is waste land and dog." The months, weeks, days, and hours are also described. Each of their hours corresponds

to two European hours, of which seven belong to the day and five to the night. The first hour commences at eleven o'clock at night.

BEETS and beet sugar form very important elements of agriculture and manufacture in Russia. Besides supplying all the wants of the empire, the sugar is exported in considerable quantities to other countries. The cost of cultivation averages about eighteen dollars an acre. Russia ranks fourth among European nations in quantity of sugar manufactured per year. The raw sugar produced by Russian factories is said to differ but little from refined sugar, and to surpass foreign raw products. The cultivation of beets is said to have had a beneficial effect on agriculture in general throughout the empire by causing the introduction of improved types of machinery and implements.

IN connection with an account of the Kootenays of British Columbia, given in the British Association, Mr. D. A. F. Chamberlain exhibited an album of drawings made by members of the tribe, which showed a well-developed artistic taste among that people. The map-drawing was remarkably well done, and showed large tracts of country delineated with much topographical skill. The whole series is to be reproduced and published in the volume of transactions of the association.

A PAPER read by Dr. Ami, of the Geological Survey, Ottawa, at a conference of members of the British Association, described twenty-six public museums and private scientific collections in the Dominion.

DR. RUDOLPH HEIDENHAIN, Professor of Physiology and Histology in the University of Breslau, who died in October, 1897, was born January 29, 1834, was graduated at Berlin in 1854, and was appointed to the professorship in Breslau, which he held during the rest of his life, in 1859. He made valuable discoveries in physiology and contributed numerous notable papers to its literature. He published a volume of *Physiological Studies* in 1856, and four volumes of *Studies of the Physiological Institute of Breslau* between 1861 and 1868. His laboratory was the source of voluminous contributions by himself, his pupils, or his assistants to Pfleger's *Archives* on a large variety of special topics in the field of his studies. His essay in Hermann's *Handbook of Physiology on the Secretion Processes*, extending over four hundred pages, is quoted in every text-book on physiology. His later researches on lymph formation and the studies conducted in his laboratory on hæmodynamics and ferment action were very important.

SIR PETER LE PAGE RENOUF, an eminent Egyptologist, keeper of Egyptian and Assyrian antiquities at the British Museum, died in October, seventy-five years of age.



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THE ÆTIOLOGY AND GEOGRAPHIC DISTRIBUTION OF INFECTIOUS DISEASES.*

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IN a recent address before a medical audience I defined the term "infectious" as follows:

"It is hardly necessary to say that by 'infectious diseases' we mean those diseases which result from the introduction into the body of some disease-producing agent. And I think we are justified in saying that an essential condition of infection is that the disease-producing agent shall be capable of reproduction in the body of the infected individual—in other words, that it is a living organism. It matters not whether this living organism is large or small; whether it belongs to the animal or vegetable kingdom; whether it is located in the skin as in scabies, in the muscles as in trichinosis, in the lymphatics as in erysipelas, in the solid viscera as in amœbic abscess of the liver, in the intestine as in cholera, or in the blood as in relapsing fever, the introduction and multiplication of the living infectious agent constitutes infection."

The terms contagious and infectious are not synonymous. A disease is contagious when it is transmitted from the sick to the well by personal communication or contact, more or less intimate; and all contagious diseases are infectious—i. e., they are due to the introduction into the body of a susceptible individual of a living germ. But all infectious diseases are not contagious. Thus smallpox, scarlet fever, measles, diphtheria, influenza, etc., are infectious diseases

* From an address read before the National Geographic Society of Washington.

which are contagious; while malarial fevers, typhoid fever, yellow fever, cholera, pneumonia, peritonitis, etc., are infectious diseases which are not contagious—at least, they are only contagious under very exceptional circumstances, and those in close communication with the sick as nurses, etc., do not contract these diseases as a result of such close association or contact.

The generalization that all infectious diseases are due to the introduction into the bodies of susceptible individuals of living germs capable of reproduction is based upon exact knowledge, gained chiefly during the past twenty years, as regards the specific infectious agents or germs of a considerable number of the diseases of this class. In some infectious diseases, however, no such positive demonstration has yet been made.

The investigations which have been made justify the statement that each infectious disease is due to a *specific*—i. e., distinct—micro-organism. There are, however, certain infectious diseases which physicians formerly supposed to be distinct, and to which specific names are given which are now known to be due to one and the same infectious agent or germ. Thus puerperal fever and erysipelas are now recognized as being caused by the same germ, the germ which is the usual cause of pneumonia is also the cause of a considerable proportion of the cases of cerebro-spinal meningitis, etc.

In considering the geographic distribution of infectious diseases we will find it necessary to divide them into two groups, one in which the specific infectious agent or germ multiplies only within the bodies of infected individuals, the other in which it also multiplies external to the bodies of infected individuals when conditions as to temperature, moisture, and organic pabulum are favorable for such external multiplication.

In the first group we have all those diseases which are transmitted only by personal contagion, direct or indirect—i. e., by contact with the sick or with articles infected by such contact (fomites). This list includes smallpox, chicken pox, measles, scarlet fever, mumps, whooping-cough, influenza, and diphtheria.

In the second group we have cholera, typhoid fever, yellow fever, and the malarial fevers.

It is evident that the geographic distribution of diseases of the first group will depend chiefly upon conditions relating to the susceptibility of different races of mankind, their knowledge of preventive measures, such as disinfection, vaccination, and isolation of the sick, their mode of life and intercourse with each other and with peoples occupying different geographic areas, etc. Nomadic savages, or people living upon islands remote from the channels of commerce, are less liable to suffer from infectious diseases of foreign

origin than are the denizens of populous regions, and especially of cities having commercial relations with all parts of the world. But when an exotic pestilential disease is first introduced among people who have previously enjoyed an immunity from it, on account of their isolation, it is usually very fatal, owing to the great susceptibility of a virgin population. This is due to the fact that there is no individual immunity resulting from a previous attack, and also to a relatively great race susceptibility as compared with a people among whom the disease has prevailed for many years. It is evident that the continued prevalence of an infectious disease in a given area will have a tendency to reduce the susceptibility of the population, in accordance with the laws of natural selection and survival of the fittest.

In illustration of this I may mention the comparative immunity of the African race to malarial fevers, which are so fatal to Europeans who visit the malarious regions of the African coast and interior; and the immunity of the native ("creole") population of those cities where yellow fever prevails as an endemic disease, as at Havana, Vera Cruz, and Rio de Janeiro.

What has been said will suffice to show that the geographic distribution of infectious diseases is to some extent influenced by the relative susceptibility of the population in various regions. The prevalence of the strictly contagious diseases also depends to some extent upon climatic conditions, although to a far less degree than is the case in our second group, which includes diseases in which the germ may multiply external to and independently of infected individuals.

In general, contagious diseases are more likely to spread in northern latitudes, and during the winter season, because the climatic conditions lead to the aggregation of individuals in towns and in closed apartments, while in southern latitudes and during the summer season a larger proportion of the population live in the open air during the daytime and sleep in well-ventilated rooms at night.

The influence of season upon the prevalence of smallpox, a strictly contagious disease, has been referred to by numerous authors, and is insisted upon by Hirsch in his *Handbook of Geographical and Historical Pathology*. In a table contained in the monumental work of Hirsch the season is given in which ninety-nine epidemics of smallpox reached their height. In sixty-seven it was during the cold season and in thirty-two during the warm season. The same thing is shown by the mortuary statistics of various civilized countries. The immunity resulting from vaccination has largely influenced the geographic distribution of smallpox epidemics, which are now almost unknown in Germany and are comparatively infre-

quent in the United States, in England, and in other countries where the value of vaccination is pretty generally recognized.

The influence of climate, and therefore of geographic distribution, upon the prevalence of certain diseases is due to its effect in increasing individual susceptibility to infection. Thus the susceptibility to influenza, to diphtheria, and to pneumonia is increased by exposure, leading to a sudden refrigeration of the body. These diseases are for this reason most prevalent in northern latitudes and during the seasons when by reason of exposure to sudden changes in the temperature there is the greatest liability to "catch cold."

It will be seen from what has already been said that the ætiology of infectious diseases does not depend alone upon exposure to infection—i. e., upon the presence of the specific infectious agent or germ, which is, however, an essential factor—but that the development of an attack may depend upon other factors which we may include under the general heads of (*a*) predisposing causes and (*b*) exciting causes. Predisposition may be either inherited or acquired. Thus the African race is especially liable to contract smallpox in its most virulent form, and the fair-skinned races of northern Europe are especially subject to fatal attacks of yellow fever. Again, certain families have a hereditary predisposition to pulmonary consumption, while others are especially liable to repeated attacks of smallpox in the same individual, etc. Youth constitutes a predisposition to certain diseases, the liability to attack being greatly diminished for scarlet fever and whooping-cough after adolescence and for tuberculosis after forty years of age. An acquired predisposition may be due to starvation or an inadequate diet as regards certain essential elements, to excessive fatigue or nervous exhaustion from any cause, to loss of blood, to alcoholic excesses, to insanitary surroundings, and in short to any of the causes which lower the vital resisting power of the individual. When such causes are general in their operation, or in times of famine, epidemics are likely to prevail, and the geographic range of these epidemics will coincide with the area in which the predisposing cause is effective.

As instances of the development of an attack from the direct action of an exciting cause (*b*), the specific germ being present, we may mention the effect of a recent debauch in causing an attack of yellow fever, of exposure to cold as the immediate cause of an attack of pneumonia or of influenza, of an attack of indigestion in developing a case of Asiatic cholera, of an injury to a joint as the exciting cause of a tubercular joint disease, etc.

What has already been said will show that the question of the geographic distribution of infectious diseases could hardly have been considered independently of questions relating to the ætiology or

causation of these diseases. This will become still more apparent when we come to speak of the geographic range of infectious diseases in which there is an external development of the specific infectious agent, for such development is strictly limited by conditions relating to climate, soil, elevation above the sea level, etc. Thus yellow fever, cholera, and the malarial fevers are essentially diseases of warm countries, or of the summer season in those portions of the temperate zone in which they prevail.

Having thus called attention in a general way to the factors which influence the geographic distribution of infectious diseases, I shall now ask your attention to a brief account of some of the more important of these diseases considered separately, and in doing so it will be necessary to refer also to their geographic distribution in past times, or, in other words, to the history of epidemics.

Epidemic influenza, or as the French call it *la grippe*, is a disease which has frequently prevailed in all parts of the civilized world, and can not be said to have any definite geographic habitat. In this regard it corresponds with smallpox and other contagious diseases, but it is only during recent years that the fact of its transmission by personal contagion has been generally recognized by physicians, and indeed it is still denied by some. This fact, however, I consider to be well established. While references to this disease are found at a much earlier period, it was not until the year 1173 that it was described with sufficient accuracy by medical writers to justify the epidemic of that year in Italy, Germany, and England to be included in a tabular list of epidemics given by Hirsch. From that time to the present very numerous epidemics have occurred. Some of these have been limited to the eastern hemisphere, or to a restricted portion of it, while others have extended to the western hemisphere and have gained a wide prevalence on this side of the Atlantic, notably so the recent prolonged epidemic which dates from 1889. If we look at a list of the recorded epidemics during the present century we shall find that the disease has probably never been entirely absent from some portion of the eastern hemisphere, although it has been comparatively restricted in its range at times, and has again gained a wide extension in Europe and Asia, and has on numerous occasions crossed the Atlantic and invaded the western hemisphere. This occurred in 1807, 1815, 1824, 1830, 1832, 1843, 1848-'51, 1857, and in 1873-'75.

Bubonic plague is a fatal infectious disease which prevails at the present day in certain portions of China and other Oriental countries, and which in the past has prevailed as a devastating pestilence in Asia and Europe. Recent researches by the Japanese bacteriologist Kitasato and by the French bacteriologist Yersin have

demonstrated the fact that the bubonic plague is due to a bacillus. No doubt the present limited geographic range of this pestilential disease is due to the great sanitary improvements which have occurred in European countries during the past two centuries. The experiments of Yersin show that rats become infected and die when they are fed upon portions of the body of victims of the plague. He also demonstrated the presence of the plague bacilli in dead rats found in the houses and streets of Hong Kong. This may account for the perpetuation of the disease in a country where rats abound, and where the victims of the plague are no doubt frequently exposed to the attacks of these voracious animals. The epidemics of plague which have occurred in Europe, so far as we are able to trace them, appear to have had their origin in the Orient. The French commissioners who were sent to Egypt in 1828 to study plague arrived at a conclusion which is in consonance with our suggestion that rats may play an important part in perpetuating the malady. Their researches convinced them that plague was unknown in Egypt previous to the year 543 (A. D.), and that its first appearance corresponds with the time when the Egyptians discontinued the practice of embalming the dead, and resorted to burial in the earth, which among the poorer classes is commonly done in a manner so inadequate that the atmosphere around a graveyard is usually filled with the products of cadaveric decomposition.

The pestilential disease which prevailed so extensively in Europe during the middle ages, and which was known everywhere as the *black death*, caused an enormous loss of life. This disease is now believed by epidemiologists to be identical with the bubonic plague of the Orient. No doubt, however, other pestilential maladies, and especially typhus, or "spotted fever," were confounded with the prevailing epidemic disease. The last-mentioned disease is sometimes known as "famine fever," on account of its liability to prevail in epidemic form during periods of scarcity of food. Typhus was not recognized by physicians as a distinct disease until about the end of the fifteenth century, and typhoid fever, which prevails as an endemic disease in all parts of the civilized world, was not differentiated from typhus until the early part of the present century. There is, therefore, considerable confusion as regards the real nature of the disease in many of the epidemics which occurred in Europe during the middle ages, and even as late as the last century. But there can be no doubt that bubonic plague was one of the chief causes of mortality. It continued to prevail in various parts of Europe during the sixteenth century, and during two thirds of the seventeenth; but during the latter part of the seventeenth century it became more and more rare, and after the middle of the eighteenth century its only

permanent habitat in Europe appears to have been a limited area in the southeastern portion, from which it occasionally spread northward, without, however, extending much beyond the limits of the Balkan peninsula. During the early part of the present century it still occurred to some extent in this region, where it prevailed as an epidemic for the last time in 1841.

Typhus fever, like smallpox, is a disease which is transmitted by personal contagion, and its dissemination depends upon human intercourse. It prevails chiefly in temperate or cold regions, and is unknown in the tropics except at considerable elevations above the sea level. In temperate regions its season of greatest prevalence is the winter and spring. There is no reason to suppose that the specific germ, which has not yet been demonstrated, is able to multiply external to the bodies of infected individuals, and, consequently, conditions relating to soil, moisture, temperature, and organic decomposition are apparently without influence in the development of the disease, except in so far as they affect the predisposition of those exposed to infection. Insanitary surroundings no doubt constitute a predisposing cause by lowering the vital resisting power of those exposed to such influences. But of all the predisposing causes war and famine are shown by the history of past epidemics to have been the most potent.

The earliest reliable accounts of epidemics of this disease date from the eleventh century, but it was not until the sixteenth century that well-recorded accounts of the epidemic prevalence of the disease were made, in the first instance by Italian physicians. The disease prevailed extensively in Italy during the years 1505 to 1530. In the seventeenth century numerous fatal epidemics occurred in various parts of Europe, the disease for the most part following in the track of contending armies, and adding to the scourge of war with its devastations and the resulting scarcity of food the disastrous effects of a deadly pestilence. During the eighteenth century the disease continued to prevail in Europe, and three notable epidemics occurred in Ireland: the first in 1708 to 1710, the second from 1718 to 1721, the third from 1728 to 1731. The last two epidemics, although most destructive of life in the famine-stricken districts of Ireland, also extended to a considerable portion of England and Scotland. In 1734 to 1744 typhus prevailed extensively in eastern and central Europe; it again obtained wide prevalence in 1757 to 1775, a period of wars and famine, and during the last ten years of the eighteenth and the early part of the present century, the period of the Napoleonic wars, it again ravaged the countries over which the contesting armies passed. Ireland appears to be one of the endemic foci of this disease, and when it has invaded

England or Scotland its origin has usually been traced to the "Emerald Isle," where frequent epidemics have occurred during the present century; that of 1826 to 1828 attained considerable proportions, and that of 1846 to 1847 was the most severe of the present century. The number of cases in the last-mentioned epidemic in Ireland is estimated to have been over a million, or about one in seven of the population.

Typhus has prevailed at various times in Mexico, Peru, and Chili, as a result of importation from Spain, since the year 1570, when it first appeared in Mexico. Its first introduction into the United States was at a much later date, and corresponds with the period of extensive emigration from Ireland to the United States and Canada during the present century. For the most part the disease has been confined to the emigrants themselves, or to their immediate attendants on board ship, at quarantine stations, or in the isolation hospitals to which the sick have been transferred. Although the disease has very frequently been brought to our seaport cities, it has rarely extended to the resident population of these towns, and is unknown in the interior of the country. In New York the disease spread to some extent in 1818, 1827, 1837, and 1847, and in Philadelphia a considerable epidemic occurred in 1836, and again in 1862 to 1864.

The conditions governing the epidemic prevalence of *relapsing fever* are very similar to those mentioned in connection with the ætiology of typhus. It is especially liable to prevail during times of scarcity of food, and indeed epidemics are very frequently coincident as to time and place with those of typhus. It is, no doubt, transmitted by personal contagion, and its prevalence is therefore largely influenced by circumstances relating to the susceptibility of individuals, their sanitary surroundings, and their aggregation in ill-ventilated apartments. It attacks more especially those individuals in infected districts who occupy the densely populated and filthy portions of towns and cities, and, as stated by Engel, is peculiarly a *morbus pauperum*, or disease of the poor. On the other hand, it is quite independent of climatic influences, and, so far as we know, has no definite local habitat. The specific germ of this disease was discovered by the German physician Obermeier in 1873. It is a slender spiral filament, endowed with very active movements, and is found in the blood of relapsing-fever patients during the primary febrile paroxysm and also during the subsequent relapses which are characteristic of the disease.

It is impossible to say when or where relapsing fever had its origin, but our first reliable accounts of the disease date from the early part of the eighteenth century, when it prevailed as an epi-

demic in Ireland and in Scotland. Subsequent epidemics have occurred in these countries on numerous occasions. The last epidemic period in the British Isles was from 1868 to 1873, when it prevailed in several of the larger cities of England as well as in Scotland. Upon the continent of Europe it has prevailed chiefly in Russia and in Germany, and the earliest reliable accounts only date back to the year 1833, when it first appeared at Odessa. In 1863 a widespread epidemic occurred in Russia, and in 1868 it prevailed extensively in Germany. It again prevailed in Germany in 1871 to 1872, and in 1878 to 1879. In North America its prevalence has been limited to a few outbreaks in seaport cities having commercial relations with infected localities in Europe. In 1844 it was brought to Philadelphia by emigrants sailing from Liverpool; in 1847 it was brought in the same way to New York and spread to some extent to neighboring towns; in 1869 it was again imported into Philadelphia, and during the two following years spread to a slight extent in this city and in the State of Pennsylvania.

If we may judge from past experience, the predisposing causes of relapsing fever are not sufficiently active in this country to give rise to a serious epidemic, even if cases of the disease should again be brought to our shores. In Egypt, in India, in China, and in the Oriental countries generally, the conditions favorable for the epidemic prevalence of this disease are more commonly met with, and there is evidence that it exists in some of these countries at the present day and has probably been endemic for a considerable period, especially in India. But it is only recently that the English physicians in India have recognized its presence, it having been confounded for many years with the widely prevalent malarial fevers of the country.

Smallpox, like typhus and relapsing fever, is transmitted by personal contagion, but the susceptibility to this disease is so general, independent of predisposing causes, that in the prevaccination period it had a wide diffusion, not only in the overcrowded tenements of the poor, but also in the dwellings of the rich and even in the palaces of kings. The writings of the distinguished Greek physician Galen, who was born about 130 A. D., indicate that he was acquainted with smallpox, but the origin of the disease is lost in the obscurity of the remote past. According to Hirsch, "the native foci of smallpox may be looked for in India and the countries of central Africa." It still prevails extensively in these countries, where vaccination is only practiced to a limited extent. In the years 1873 and 1874 the mortality from this disease in India is said to have been five hundred thousand. "On European soil the smallpox, up to the beginning of this century, or to the introduction of vaccination, had been one

of the most widely distributed, most frequent, and most destructive of pestilences" (Hirsch).

The disease was introduced to the West Indies and to Mexico at an early date after the discovery of the "western world," and nearly every fresh outbreak during the sixteenth and seventeenth centuries can be traced to importation from Africa by ships engaged in the slave trade. The entire native population, not having previously been exposed to the ravages of this disease, was susceptible to infection, and "it was so disastrous that whole tribes were exterminated by it. . . . The disease reached Mexico for the first time in 1520 with troops from Spain; the number of persons swept off in a short time has been estimated at three millions and a half" (Hirsch). The disease was first introduced into one of our Atlantic seaports about the middle of the seventeenth century, when it prevailed in Boston. Since that date numerous localized epidemics of greater or less extent have occurred in various parts of the United States, but, owing to the early adoption of the practice of vaccination, it has not obtained a wide diffusion among the white population. It has, however, been very destructive to the aboriginal inhabitants of the country.

We must now turn to the second group of infectious diseases, viz., those in which the specific germ may multiply, under favorable conditions as to climate and soil, external to the bodies of infected individuals, and which have consequently a more or less well-defined geographic range.

In the case of typhoid fever and of the malarial fevers, which belong to this group, the geographic range is very extensive, while in cholera, in yellow fever, and beriberi it is more limited, as will be seen when I come to speak of these several diseases. The specific germ of *typhoid fever* is now well known, it having been first observed by the German physician Eberth, and independently by the celebrated German bacteriologist Koch, in the year 1880. Its causal relation to the disease was not established until some years later, but is now generally recognized by pathologists and well-informed physicians. This germ is found in the ulcerated glands of the intestine and consequently in the intestinal contents. The discharges from the bowels of typhoid patients, therefore, contain the germs of the disease, which probably multiply indefinitely if they find their way to shallow wells or streams at a season of the year favorable for such development. At all events, whether active development occurs or not, it is well established that typhoid fever is usually contracted by drinking water contaminated by the discharges of typhoid patients. To discuss the relations of this disease to season, temperature, latitude, local insanitary conditions, etc.,

would require far more space than is available at present. It prevails as an endemic disease in all the inhabited parts of Europe, Asia, and America, and the occurrence of epidemic outbreaks depends largely upon an unusual degree of contamination of the water supply of a community by the discharges of those sick with the disease. It may prevail at any season, but as a rule the autumn months afford more cases than occur at other seasons of the year. It is more prevalent in the temperate zone than in the tropics, but in the Orient it claims many victims in tropical regions, and especially in the densely populated portions of India.

Extended experience gained in this country and in Europe shows that the relation of this disease to local insanitary conditions is very marked, and that the typhoid mortality rate is a good index of the general hygienic conditions of a town or city, especially as regards purity of water supply and efficiency of sewage disposal.

Asiatic cholera is a fatal pestilential disease which has its permanent habitat in India, and which during the present century has repeatedly invaded the countries of Europe, and has even crossed the Atlantic and prevailed as an epidemic in certain portions of the western hemisphere. In India it has, no doubt, prevailed from a remote period, and its chief endemic seat in that country appears to be in lower Bengal. The deaths from cholera in the various provinces of India during the five years from 1871 to 1875 amounted to more than seven hundred and fifty thousand.

As regards its epidemic extension to the countries of Europe, cholera is a disease of the present century. The first great epidemic dates from the year 1817, and the disease did not disappear from European soil until 1823. A second period of prevalence in Europe lasted from 1826 to 1837, a third from 1846 to 1863, a fourth from 1865 to 1875, and the fifth and last from 1892 to the present date. The time at my disposal will not permit me to trace the origin and progress of these epidemics; but the general statement may be made that they had their origin in India, and that the progress of the disease was along routes of travel, showing that its propagation depends upon human intercourse. Since the discovery of the cholera spirillum by Koch, in 1884, the method in which the disease is spread has been established in a most satisfactory manner. We now know that the germs of the disease are found in immense numbers in the intestine of cholera patients, and even in individuals who have been exposed to infection, but who manifest no symptoms of the disease other than a slight diarrhœa. Such persons sow cholera seed with the discharges from their bowels, and under favorable conditions rapid multiplication of the germ occurs outside of the body. Infection usually occurs by the ingestion of water or food contami-

nated by such germs, and it has been shown with a great degree of probability that such contamination frequently results from the transportation of infectious material from the surface of the ground, from shallow pits, etc., by flies, which after visiting the most filthy places, may alight upon a beefsteak or fall into the milk jug in a well-ordered kitchen. But by far the larger number of cases result from drinking water containing the cholera germ.

The epidemic extension of cholera depends upon climatic conditions to a much greater extent than does that of typhoid fever. It is especially a disease of hot climates, and of the summer months in temperate regions. The disease may be propagated during the winter, even in cold climates, by the occurrence of a series of cases in localities especially favorable for such propagation, and in this case a recrudescence of the epidemic usually occurs during the following summer. In Russia, during the years 1853 to 1855, nearly two hundred and fifty thousand deaths occurred during the months of June, July, August, and September, and less than twenty-five thousand during the remaining months of the year. In 1832 cholera was introduced into Canada by emigrants from Ireland, and spread rapidly in the valley of the St. Lawrence. An independent importation during the same year brought it to New York and to New Orleans, from which points it obtained a tolerably wide diffusion in the United States. In 1835 it appeared for the first time in South America, on the coast of Guiana. North America was again visited by the scourge in 1848, and it continued to prevail in the United States and Mexico for several years, especially in 1849 to 1850. In the West Indies it caused a considerable mortality in the period from 1850 to 1854. During the year 1854 it again became widely prevalent in the United States. In 1865 the West Indies suffered from another severe epidemic, and in the following year the disease again established itself at three widely separated seaports in North America—Halifax, New York, and New Orleans. From the last-mentioned port it extended throughout the Mississippi Valley. During the years 1865 to 1868 the disease also committed great ravages in some of the South American countries not previously visited by it, and especially in Brazil, Paraguay, Uruguay, and the Argentine Republic. In 1873 cholera was again imported to New Orleans and spread throughout a considerable portion of the Mississippi Valley. Our exemption from an epidemic during the recent widespread prevalence of the disease in Europe is, no doubt, due to the efficient methods for its exclusion adopted at our ports of entry, and especially at New York, where several cholera-infected ships arrived during the height of the Hamburg epidemic of 1892.

Yellow fever is essentially a disease of the littoral, and especially

of seaport cities in tropical and semitropical regions, but in these regions its prevalence is greatly restricted. In North America, although it has occasionally prevailed as an epidemic in every one of our seaport cities as far north as Boston, and in the Mississippi Valley as far north as St. Louis, it has not established itself as an endemic disease within the limits of the United States. In South America it has prevailed as an epidemic at all of the seaports on the Gulf, and on the Atlantic coast as far south as Montevideo and Buenos Ayres; also at several seaports of Mexico and Peru on the Pacific. At present the principal endemic foci of the disease are Havana, Vera Cruz, and Rio Janeiro. In Africa the disease is limited to the west coast, and so far as we know no epidemics have prevailed in the interior of tropical Africa, although the conditions would appear to be favorable for the development of an epidemic in case the disease should be introduced. The same is true as regards the populous regions in northern Africa and southern Asia where the rainfall is sufficient. The disease does not prevail in arid regions, or at considerable elevations above the sea level.

Yellow fever does not prevail as an endemic disease in places which have a mean winter temperature much below 65° F. (18.3° C.), and as a rule epidemics are not developed at a lower temperature than 75° to 80° F. (23.8° to 26.6° C.). The approach of cool weather checks the progress of an epidemic, and in those endemic foci of the disease (Havana, Rio de Janeiro, Vera Cruz) where it prevails annually it is essentially a disease of the summer months. That moisture is an essential factor is indicated by the fact that the disease does not prevail in arid regions where other conditions appear to be favorable, and that it is especially a disease of the seacoast and of the margins of great rivers. Heavy rains, however, exercise a favorable influence in checking an epidemic—probably by cleansing the streets, sewers, etc., in an infected locality. In the tropics the commencement of the rainy season often puts an end to the prevailing epidemic.

Decomposing matter of animal origin appears to form a favorable nidus for the development of the hypothetical yellow-fever germ. It is a disease of towns and cities, and especially of such as are in an insanitary condition. The writer's studies have led him to the conclusion that the infectious agent, as in cholera and in typhoid fever, is probably present in the discharges of the sick.

The early history of yellow fever is involved in obscurity, and it is doubtful whether we will ever be able to settle in a definite manner the disputed question as to its origin. Two principal theories have been advanced: one that it was endemic at certain points on the shores of the Gulf of Mexico at the time of the discovery of the New

World; the other that it was imported to the West Indies from the African coast, probably by vessels engaged in the slave trade, soon after the occupation of the country by the Spaniards. It seems necessary to look for an original endemic focus of the disease elsewhere than in the West Indies, for the reason that, in the few places where it is now endemic, there is historical evidence to show that the disease was originally imported, and that prior to such importation it was unknown.

In Brazil, according to the best medical authorities in that country, yellow fever was not endemic at any of the seaport cities prior to the year 1849. From Brazilian ports the disease has occasionally been introduced to the cities at the mouth of the Rio de la Plata, and has there caused great loss of life.

According to Hinemann, yellow fever was unknown at Vera Cruz prior to the year 1699, a year in which it was widely prevalent in the West Indies. This city is now recognized as one of the endemic foci of the disease, and epidemics at other towns on the Mexican coast have usually been traced to importation from Vera Cruz. The Gulf coast of South America, and especially the French and English settlements in Guiana, have been frequently visited by epidemics of yellow fever. In Venezuela the disease has occasionally prevailed at Caracas and at the neighboring seaport, La Guayra. In Central America epidemics have occurred at all the principal seaports. Upon the Pacific coast of South America the disease was imported to Callao in 1854, and extended from this port to the Peruvian capital and to the principal towns on or near the seacoast. It continued to prevail to some extent until 1869.

The history of yellow fever in the United States shows that the disease is an exotic which has not found the conditions favorable for its continued development at any of our seaport cities. It is true that for many years it prevailed almost annually at New Orleans, but since efficient quarantine regulations have been enforced the disease has been excluded, and no epidemic has occurred in this city since 1878, a period of eighteen years, until the present year. The epidemics in this city attended with the largest mortality occurred in 1819 (mortality, 2,190), in 1847 (2,259), 1853 (7,970), 1854 (2,423), 1855 (2,670), 1858 (3,889), 1867 (3,093).

At Galveston, Mobile, and Pensacola on the Gulf coast, and at Charleston and Savannah on the Atlantic, epidemics were formerly of frequent occurrence, but these cities have also learned to protect themselves by suitable quarantine regulations. The last epidemic occurred in Galveston in 1867 (mortality, 1,150), in Mobile in 1878, in Pensacola in 1882, in Savannah in 1876, in Charleston in 1871.

During the latter part of the eighteenth and the early part of the

present century several severe epidemics of yellow fever occurred in New York and in Philadelphia, and even as far north as Boston. In the great epidemic of 1798 the mortality in Boston was 200; in New York, 2,080; and in Philadelphia, 3,500. The last-named city suffered a series of epidemics about this time—1797 (mortality, 1,300), 1798 (mortality, 3,500), 1799 (mortality, 1,000), 1802 (mortality, 307), 1803 (mortality, 195), 1805 (mortality, 400). The immunity of these cities for many years, notwithstanding their intimate commercial relations with Havana and other infected ports, is in my opinion largely due to sanitary improvements, and especially to the construction of sewers and paving the streets; also to the enforcement of suitable quarantine regulations.

The great epidemics in the United States during the present century occurred in 1853, 1867, 1873, 1878. The epidemic of 1878 was the most disastrous known; 132 towns were invaded, and the mortality was 15,934 (number of cases about 74,000).

In Europe the ravages of yellow fever have been chiefly restricted to Spain and Portugal. This is due to the facts that meteorological conditions are there favorable for the development of the exotic micro-organism to which the disease is due, and that these countries have constant commercial intercourse with infected ports in the West Indies. The first epidemic in Spain occurred in 1700 at Cadiz. This city also suffered in 1730-'31, 1733-'34, 1764, 1780, 1800, 1804, 1810, 1819-'21. The epidemics of 1800, 1810, and 1819 were not limited to the city of Cadiz; the disease extended to the interior, and caused a considerable mortality in the provinces of Granada and Andalusia. In 1878 a limited epidemic occurred for the first time in Madrid. The first Lisbon epidemic was in 1723; the great epidemic in this city was inaugurated in 1856,* and reached its acme of development the following year.

Upon the west coast of Africa yellow fever prevails principally along the coast of Sierra Leone. At St. Louis (Senegal) an epidemic occurred in 1778, the first of which we have any knowledge in this vicinity. Frequent epidemics have occurred in Senegambia, and the disease has occasionally prevailed upon the Gold coast, the Congo coast, the Cape Verd Islands, and the Canary Islands. At Nassau in the Bahama Islands yellow fever prevailed as an epidemic in 1861, 1862, 1863, and in 1869.

Another infectious malady which, like yellow fever, has a very restricted endemic prevalence is the disease known as *beriberi*. This prevails chiefly upon the seacoast of Oriental countries, and upon the islands in proximity to these coasts in the Pacific and Indian Oceans. It has been imported to the West Indies and to Brazil, where it prevails to a limited extent in the coast region.

The space at my disposal will not permit me to discuss the ætiology of this disease, but I may say *en passant* that the specific infectious agent, or germ, of the disease has not yet been demonstrated in a satisfactory manner, although claims to its discovery have been made.

My subject is too extensive to be treated in a single paper, and I am unable at present to consider many important infectious diseases of man and of the lower animals. Among these I may mention as especially important the malarial fevers, pulmonary consumption, pneumonia, leprosy, the diseases due to animal parasites of various kinds, those due to parasitic fungi other than the bacteria, contagious ophthalmia, etc. Among the most important infectious diseases of the lower animals, some of which may be transmitted to man by inoculation, are anthrax, glanders, hydrophobia, symptomatic anthrax or "black leg" of cattle, Texas fever of cattle, the surra disease of India, the tsetse-fly disease of Africa, fowl cholera, etc.



THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

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XII.—THE ARYAN QUESTION.

IN our school days most of us were brought up to regard Asia as the mother of European peoples. We were told that an ideal race of men swarmed forth from the Himalayan highlands, disseminating culture right and left as they spread through the barbarous West. The primitive language, parent to all of the varieties of speech—Romance, Teutonic, Slavic, Persian, or Hindustanee—spoken by the so-called Caucasian or white race, was called Aryan. By inference this name was shifted to the shoulders of the people themselves, who were known as the Aryan race. In the days when such symmetrical generalizations held sway there was no science of physical anthropology; prehistoric archæology was not yet. Shem, Ham, and Japhet were still the patriarchal founders of the great racial varieties of the genus *Homo*. A new science of philology dazzled the intelligent world by its brilliant discoveries, and its words were law.

We have no time to trace here in detail the revolution of opinion

which the last quarter century has produced. This has been done for us by a master hand.* The logical rottenness of the Asiatic hypothesis, even from the linguistic point of view alone, speedily revealed itself to Latham, Omalius d'Halloy, and others; their contentions were supported by evidences of man's existence in Europe from the remotest antiquity, and of his gradual acquisition of culture on the spot. Then, nearly twenty years ago, arguments based upon the physical characteristics rather than the languages of living European peoples began to be injected into the controversy by Poesche, Penka, and others. Within a decade, physical anthropology dealing with living men, has struggled to its feet and claims the floor—perhaps to the damnation of its predecessors. It may justly be affirmed that no other scientific question, with the exception of the doctrine of evolution, was ever so bitterly discussed, or so confounded at the hands of biased writers by religious and national prejudice.

So much by way of introduction. Let us now at the outset distinguish culture, language, and race; let us rigidly avoid confusing them in any respect. The cultural evidence in turn may be resolved into several distinct parts: arts or customs, language, and perhaps even mythology. Each concerns an entire science by itself. Their relative importance is indicated in the order of naming. The credibility of the testimony of each varies directly with its liability to migrate in entire independence of any actual movement of peoples. Physical traits, of course, are absolutely certain; arts and customs are less apt than is language to be acquired abroad by mere contact. Mythologies are most fluid of all. In this paper we shall deal merely with the first of all these, namely, race, leaving the matter of the origin of culture for future treatment. We shall deal with physical anthropology and the witness of prehistoric archæology alone. Finally, we shall strive conscientiously to distinguish between the positively proved and the merely hypothetical. We shall advance by propositions, keeping them in martial order, as we are entering debatable territory. One great advantage alone we may claim. As Americans, we should be endowed with "the serene impartiality of a mongrel," as the late Professor Huxley put it. No logical conclusion has terror for us. Whether the noble Aryan be

* The best statement of the progress of opinion upon the Aryan question is given by Canon Taylor in the opening chapters of his *Origin of the Aryans*. Dr. Beddoe, in his *Anthropological History of Europe*, has succinctly touched upon it also. In our *Bibliography of the Anthropology and Ethnology of Europe*, soon to appear in a *Bulletin of the Boston Public Library*, we have collected about a hundred titles of books and monographs on this subject, indexed chronologically. This affords a striking picture of its relative importance in the domain of ethnology. For convenience we shall refer to all papers in this reference list by means of authors and dates alone. Full titles can be obtained by consulting the list.

proved Teuton, Celt, or Iberian, it is all the same. We have no monopoly of inheritance in it in any case.

I. *The European races, as a whole, show signs of a secondary or derived origin; certain characteristics, especially the texture of the hair, lead us to class them as intermediate between the extreme primary types of the Asiatic and the negro races respectively.*

From what we have seen of the head form, complexion, and stature of the population of Europe, we might be led to expect that in other physical traits as well this little continent contained all extremes of human variation. We have been surprised, perhaps, at the exceeding diversity of forms occurring within so restricted an area, and in a human group which most of us have perhaps been taught to regard as homogeneous. One physical characteristic alone affords justification for this hypothesis of ethnic homogeneity. This is the form and texture of the hair. Only in this respect, not in color, the hair is quite uniform all over Europe, and even far into Hindustan, where Aryan languages have migrated. At the same time, however, this texture in itself indicates a secondary origin—that is to say, it denotes a human type derived from the crossing of others which we may class as primary. The population of Europe, in other words, should be numbered among the secondary races of the earth. What its constituent elements may have been we shall discuss somewhat later.

The two extremes of hair texture in the human species are the crisp curly variety so familiar to us in the African negro; and the stiff, wiry, straight hair of the Asiatic and the American aborigines. These traits are exceedingly persistent; they persevere oftentimes through generations of ethnic intermixture. It has been shown by Pruner Bey and others that this outward contrast in texture is due to, or at all events coincident with, real morphological differences in structure. The curly hair is almost always of a flattened, ribbon-like form in cross section, as examined microscopically; while, cut squarely across, the straight hair more often inclines to a fully rounded or cylindrical shape. It may be coarse, or fine, or of any color, but the texture remains quite constant in the same individual and the same race. Moreover, this peculiarity in cross section may often be detected in any crossing of these extreme types. The result of such intermixture is to impart a more or less wavy appearance to the hair, and to produce a cross section intermediate between a flattened oval and a circle. Roughly speaking, the more pronounced the flatness, the greater is the tendency toward waviness or curling, and the reverse.

Our map herewith represents the geographical distribution of these several varieties of hair texture among the races of the earth.



TEXTURE OF HAIR

As in all our preceding world maps, we have to do with the aboriginal and not the imported peoples. Our data for North America apply to the Indians alone, before the advent of either the whites or negroes. These latter depart in no wise physically from the types whence they were derived. It appears that most of Asia and both the Americas are quite uniformly straight-haired. At the other extreme stands Africa, and especially Papua and the archipelago to the southeast of it, which as far as the Fiji group is known as Melanesia, or the "black islands." This map strikingly corroborates the evidence presented by our other world maps, showing the distribution of the head form and the skin color. Generally speaking, the aphorism holds that the round-headed people are also round-haired. The black-skinned races are, on the other hand, generally long-headed and characterized by hair of an elongated oval in cross section. Physical anthropologists, to be sure, distinguish several subvarieties of this curly hair. Thus, among the Bushmen and Hottentots at the southern tip of Africa, the spirals are so tight that the hair aggregates in little nubbles over the scalp, leaving what were long supposed to be entirely bald spots between. This is known as the peppercorn type, from its resemblance to such grains scattered over the head. And in Melanesia the texture is not quite like that of the main body of the Africans; but for all practical purposes they may all be classed together.

The remaining tints upon our map denote the extension of the wavy textured hair, which is generally intermediate in cross section, varying from ribbonlike to nearly cylindrical shape. There are three separate subdivisions under this head. Two of these, the Polynesian and the Australian, are most certainly wavy-haired mongrels, derived from intermixture of the straight-haired Asiatic races with the extreme frizzled type of Melanesia. This latter is by all authorities regarded as the primitive occupant of the Pacific archipelago, and of Indonesia as well. Among the Malays, and such hybrids as the Japanese, the Asiatic type preponderates; in the Australian peoples the other element is more strongly represented. Tasmania is quite distinct from its neighboring continent. Isolation perhaps has kept it true to its primitive type. The Polynesians and Micronesians seem to be compounded of about equal proportions of each. Of course, all sorts of variations are common. The peoples of the Pacific are peculiarly aberrant in this respect. Some islands are characterized by quite lank and coarse-haired types; some have the frizzled hair stiffened just enough to make it stand on end, producing those surprising shocks familiar to us in our school-geography illustrations of the Fiji islanders.

What shall we say of the European races, the third of our inter-

mediate types? Here also all individual variations occur, seemingly in utter defiance of any law. The Italian is as apt to be straight-haired as the Norwegian; in either nation the curly variety seems to occur sporadically. Yet common observation, to say nothing of microscopical examination, would naturally class the population of Europe among the fine-textured, wavy-haired races of the earth. One never sees the wiry form so familiar in the American Indian, or the frizzle of the full-blooded negro. Are we to infer from this that the people of Europe, therefore, are, like the Polynesians and Australians, the result of an ethnic cross between other more primary types? Certainly the study of the head form, with every extreme known to man within the confines of the single continent, seems to discredit this possibility. The only alternative is to consider this texture of hair to be a more liquid characteristic, so to speak, than the shape of the head; in other words, to assume that a few drops of alien blood might suffice to produce an intermediate texture of the hair, and yet not be adequate to modify the head form. If this were indeed so, then we might imagine that, even while our three European races have kept reasonably distinct in head form, intermixture has nevertheless taken place to some extent in every nook and corner of the continent; and that this infinitesimal crossing has been enough to modify the hair texture. But we are now wandering off into vague hypothesis. There is yet enough that is positively known to demand our attention without indulging in speculation. We have stated the situation; let the reader draw his own conclusions.

II. *The earliest and lowest strata of population in Europe were extremely long-headed; probability points to the living Mediterranean type as most nearly representative of it to-day.*

Of these most primitive races, coexisting with a fauna and flora now extinct or migrated with change of climate from central and western Europe, oftentimes no remains exist except the skulls by which to judge of their ethnic affinities. We know more, in fact, concerning their culture than their physical type in the earlier stone age at least; but it is nevertheless established beyond all question that they were dolichocephalic, and that, too, to a remarkable degree. This feature characterized all subdivisions of the populations of this epoch. Many varieties have been identified by specialists, such as the stocky, short-statured Neanderthal type and the taller and more finely molded Cro-Magnon race. The classification of each nation differs in minor details, but they all agree in this, that the population both of the early and the late stone age was long-headed to an extreme.

The present unanimity of opinion among archæologists concerning this earliest dolichocephalic population is all the more remark-

able because it represents a complete reversal of the earliest theories on the subject. Retzius, in 1842, from a comparison of the Scandinavians with the Lapps and Finns, propounded the hypothesis that the latter broad-headed brunette types were the relics of a pre-Aryan population of Europe. Their comparative barbarism confirmed him in this view. It seemed to be plain that this Mongoloid or Asiatic variety of man had been repressed to this remote northern region by an immigrant blond, long-headed race from the southwest. Nilsson adopted this view; it was stoutly maintained by Pruner Bey in France, and most leading authorities of the day. Then began the discoveries of abundant prehistoric remains all over Europe, particularly in France. These with one accord tended to show that the European aborigines of the stone age were not Mongoloid like the Lapps after all, but the exact opposite. In every detail they resembled rather the dolichocephalic negroes of Africa. The only other races approaching them in long-headedness are either the Eskimos, whom Boyd Dawkins believes to be a relic of this early European people, or else the Australians. Mr. Huxley long ago asserted these savages in turn to be our human progenitors. We need not stop to discuss either of these radical opinions. It is sufficient for us that Broca finally dealt the death blow to the older view in 1868 by the evidence from the caves of Périgord, the very district where our living Cro-Magnon type still survives, as we have already shown.

This dolichocephalic substratum has been traced all over Europe with much detail in the neolithic or late stone age, by which time the geography and the flora and fauna of the continent had assumed in great measure their present conditions. We know that the long-headed races, now found living on the northern and southern outskirts of Europe, in Spain, southern Italy, the British Isles, and Scandinavia, once occupied territory close up to the foot of the high Alps on every side. Remains of it have not yet been found in the mountains themselves, although closely hedging them in on every side. For example, Zampa,* Nicolucci,† and Sergi‡ have alike collected evidence to prove that the whole basin of the Po River, now a strongly brachycephalic center, was in the neolithic period populated by this long-headed type. In other words, Italy, from end to end, was once uniform anthropologically. For France, a recent summary of the human remains of the late stone age, based upon nearly seven hundred skeletons or skulls, shows an overwhelming preponderance of this long-headed type.* The roundheads were almost entirely absent in the beginning, as in our last article we showed them to have been

* 1891, pp. 77 *seq.*; also 1891, p. 175.† 1883, pp. 118 *seq.*‡ 1888, pp. 2 *seq.*

* Salmon, 1895.

in the British Isles during the same epoch. France was apparently very unevenly populated. In all the uplands, especially the central plateau of Auvergne and in the Alps, human remains are less abundant, although when occurring being of the same decidedly long-headed type—this, be it remembered, in those sterile uplands where to-day, as we have shown, one of the roundest-headed populations in the world resides. Less easy to summarize is the evidence from Germany, but the scattered investigations all point the same way.* As for Spain, northern Africa, and Scandinavia,† the earliest types seem to have always been identical in head form with the ones there living to-day, decidedly dolichocephalic. Nor is there in Russia any contradiction of this law, as Bogdanov has shown.

Assuming it as proved, therefore, that the head form of the first population of Europe was of this quite uniform type, what do we know of its other physical characteristics? This concerns the second half of our primary proposition. That is to say, may we decide to which branch of the living long-headed race it belonged; that of the tall, blond Teuton or of the shorter-statured, dark-complexioned Mediterranean type? It is a matter of no small moment to settle this if possible. Unfortunately, we can prove nothing directly concerning the complexion, for of course all traces of hair have long since disappeared from the graves of this early period. Presumptively, the type was rather brunette than blond, for in the dark color of hair and eye it would approach the foundation tints of all the rest of the human race. The light hair and blue eye of northern Europe are nowhere found in any appreciable proportion elsewhere, save perhaps among the Ainos in Japan, an insignificant people, too few in numbers and too remote to affect the generalization. If, therefore, as all consistent students of natural history hold to-day, the human races have evolved in the past from some common root type, this predominant dark color must be regarded as the more primitive. It is not permissible for an instant to suppose that ninety-nine per cent of the human species has varied from a blond ancestry, while the flaxen-haired Teutonic type alone has remained true to its primitive characteristics.

We are strengthened in this assumption that the earliest Europeans were not only long-headed, but also dark-complexioned, by various points in our inquiry thus far. We have proved the prehistoric antiquity of the living Cro-Magnon type in southwestern France, and we saw that among these peasants the prevalence of black hair and eyes is very striking. And again in our last article,

* Ecker, 1865, p. 79, said mixed; but von Hölder, 1876, p. 20, found purer; Virchow, 1872, p. 191.

† Jacques, 1888, p. 221; Arbo, 1887, etc.

comparing types in the British Isles, we saw that everything tended to show that the brunette populations of Wales, Ireland, and Scotland constituted the most primitive stratum of population in Britain.

As to stature, a trait in which the Teuton and the Iberian differ markedly from one another to-day, we have abundant evidence that this neolithic population was more akin to the medium-statured French than to the relatively gigantic Germans and Scandinavians. The men of this epoch were not, to be sure, as diminutive as the modern south Italians or the Spaniards; they seem rather to approximate the medium height of the inhabitants of northern Africa. These Berbers and their fellows, in fact, shading off as they do into the negro race south of the Sahara, we must regard as having least departed from the aboriginal European type. And in Europe proper the brunette long-headed Mediterranean race is but slightly aberrant from it. It may have become stunted by too protracted civilization, it may have changed somewhat in facial proportions, but on the whole it has remained true to its ancestral image.

III. *It is highly probable that the Teutonic race of northern Europe is merely a variety of this primitive long-headed type of the stone age, both its distinctive blondness and its remarkable stature having been acquired in the relative isolation of Scandinavia through the modifying influences of environment and of natural selection.*

This theory of a relationship between the two long-headed races of Europe is not entirely novel. Canon Taylor hints it under his breath as a remote possibility. We affirm it as the best working hypothesis possible in the light of recent investigations. It will be seen at once that this theorem rests upon the assumption that the head form is a decidedly more permanent racial characteristic than pigmentation. In so doing it relegates to a secondary position the color of the hair and eyes, which so eminent an anthropologist as Huxley has made the basis of his whole scheme of classification of European peoples. Dr. Brinton, and after him Keane, have likewise relied upon these traits in tracing their Aryan race to a lair in northern Africa. Nevertheless, we do not hesitate to affirm that the research of the last ten years has turned the scales in favor of the cranium, if properly studied, as the most reliable test of race. We know that brunetteness varies with age in the same individual—that is one proof of its impermanence. In a preceding article * we devoted some attention to proving also that there is a factor of the environment in mountainous or infertile regions which operates to increase the proportion of blond traits among men. We did not seek

* Popular Science Monthly, vol. 1, 1897, pp. 772-780; consult also Buchan, cited by Beddoe, 1893, p. 10.

to determine whether this were due to climate alone, or to the defective nutrition which too often attends a poverty of environment. It is a well-recognized law in the geographical distribution of lower forms of life that two hundred and fifty feet increase in altitude is equivalent to one degree's remove in latitude from the equator. If this be true, applied to man, it would lead us to expect a steady increase of blondness toward the north of Europe, a fact which all our maps have substantiated fully. Experience in colonizing Africa to-day indicates that such adaptation of the Teutonic race to a northern climate constitutes a serious bar to its re-entry into the equatorial regions.* May not this change physiologically be correlated in some way with the modified pigmentation? We should assume, in other words, that as the primitive long-headed type of the stone age gradually spread over northern Europ  , environmental influences slowly, very slowly, through scores of generations, would lead this subvariety to emerge. Its differentiation would then be commensurate with the distance from its original southern center of migration—whether a direct product of environment or merely indirectly through natural selection is not for us to determine as yet.

Climate as an explanation for the derived blondness of the Teutonic race is, however, not sufficient by itself to account for the phenomenon. It neglects a significant fact on which we laid emphasis in an earlier chapter, viz., that blondness not only decreases as we proceed southward from Scandinavia, but in an easterly direction as well. In other words, the Russians at the latitude of Norway and Sweden are far more brunette in type. How shall we reconcile this with our environmental hypothesis? In the first place, the hordes which speak the Slavic languages are all comparatively recent immigrants in Europe; they are physically allied to the broad-headed Alpine type. This we shall explain in a succeeding paragraph. For this reason, comparisons between Scandinavia and the lands directly east of it are vitiated at once. But there is yet another reason why we may expect these Teutons to be notable even in their own latitude by reason of their blondness. It is this; that the trait has for some reason become so distinctive of a dominant race all over Europe that it has been rendered susceptible to the influence of artificial selection. Thus a powerful agent is allied to climate to exaggerate what may once have been an insignificant trait. Were there space we might adduce abundant evidence to prove that the upper classes in France, Germany, Austria, and the British Isles are distinctly lighter in hair and eyes than the peasantry.† The classical

* Popular Science Monthly, vol. xlviii, 1896, p. 785.

† Von H  lder, 1876, p. 15; Beddoe, 1870, p. 177, and 1885, p. 187, comparing different classes in Cork, Ireland; Taylor, 1889, p. 244.

Latin writers abound in testimony to this effect. We know also that the Teutonic conquerors of prehistoric times, the Reihengräber, for example, were of this type. Both tall stature and blondness together constitute insignia of noble descent. Gummere has collected some interesting materials from mediæval literature on this point.* The thrall or churl is invariably a dark type, the opposite of the flaxen-haired, blue-eyed jarl or earl. Let us suppose, then, that such an opinion concerning nobility became widespread; suppose that it were intensified by the splendid military and political expansion of the Teutons in historic times all over the continent; suppose it to have become the priceless heritage of people more or less isolated in a corner of Europe! Is there any doubt that, entirely apart from any natural choice exerted by the physical environment, an artificial selective process would have been engendered, which in time would become mighty in its results? Is it not permissible to ascribe in some measure both the patent blondness of this Teutonic race and its unique stature as well to this cause? This is our hypothesis at all events.

IV. *It is certain that, subsequent to the partial occupation of Europe by a dolichocephalic Africanoid type in the stone age, an invasion by a round-headed race of decidedly Asiatic affinities took place. This intrusive people is most nearly represented to-day by the Alpine or Celtic type of central Europe.*

We know that the broad-headed layer of population was not contemporary with the earliest stratum we have described above, because its remains are often found directly superposed upon it geologically. From all over western Europe comes testimony to this effect. We saw in our last article how clear the distinction was in Britain. France and northern Italy give us the clearest proof of it. Often-times where several layers of human remains are found in caves or other burial places, the long-headed type is quite unmixed in the lowest stratum; gradually the other type becomes more frequent, until all across central Europe it outnumbers its predecessor utterly. The intensity of this supersession becomes more marked in proportion as we approach the Alps, the present stronghold of the Alpine broad-headed race. Here, however, in the mountains themselves, as we have already said, no displacement of an earlier population seems to have been necessary; for from Switzerland, Auvergne in south central France, and the German Alps eastward, the inhospitable highlands seem to have been but sparsely if at all occupied by the earlier long-headed races. At all events, it is certain that in these restricted areas the broad-headed type is the most primitive. There

* *Germanic Origins*, pp. 62 *seq.*

it has remained in relative purity ever since. From the earliest remains of the lake dwellers; before iron was used; before many of the simpler arts of agriculture or domestication of animals were developed; man has in these Alps remained perfectly true to his ancestral type.* We can add art after art to his culture, but we can not till very recent times detect any movement of population after the first occupation in a state of relative savagery by this broad-headed race.† It is a surprising instance of persistence of ethnic types.

Let us trace the extension of this invasion of the Alpine race into Europe. Its limits were once much broader than they are to-day. Evidence accumulates to show that it spread widely at first, but that it was afterward obliged to recede from its first extravagant claims to possess all Europe. In our last article we saw that all along the southwest coast of Norway clear evidence of intermixture with this broad-headed type appears. The peasantry show a distinct tendency in this direction. In Denmark the same thing is true; the people are not as pure Teutons as in Hanover.‡ We also know that this race invaded Britain for a time, but was exterminated or absorbed before reaching Ireland. A very peculiar colony of these Alpine invaders seems also to have so firmly intrenched itself in the Netherlands that its influence is apparent even to this day. As we have not described the population of this interesting country in any of our papers heretofore, it will repay us to consider it for a moment.*

Attention was first directed to the Netherlands in 1876 through a remarkable paper by Virchow, in which he analyzed a series of skulls from Friesland and from the islands of Urk and Marken in the Zuider Zee. In this he declared that the long-headed people there resident were not Teutons at all; but by reason of the peculiar low-vaulted formation of the cranium were to be regarded as far more ancient types. He asserted that here in these unattractive lowlands and islands was a last relic of the Neanderthal race of the early

* Studer and Bannwarth, p. 14; Rüttimeyer and His, pp. 41 *seq.*; Zuckerhandl, 1883; Matiegka, 1890.

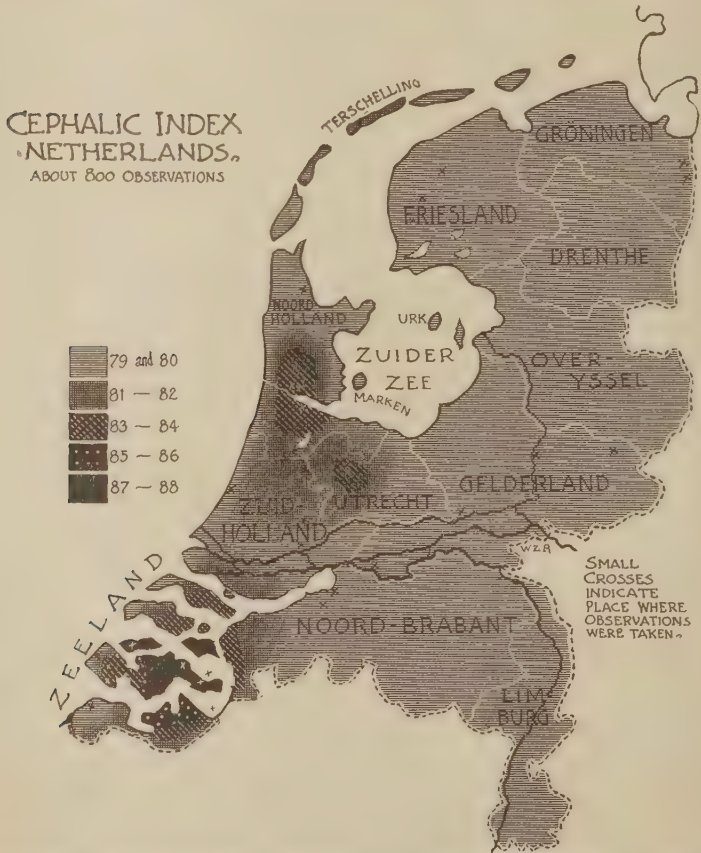
† Keller's Reports on the Lake Dwellers prove this advance in culture *in situ*.

‡ Virchow, 1870, pp. 63 *seq.*

* The standard authorities on Holland are Drs. A. and J. Sasse, of Zaandam, and Dr. J. C. De Man, of Middelburg, in Zeeland. A full list of their papers will be found in our Bibliography previously mentioned. To the last two I am deeply indebted for assistance in collecting material, which I shall publish more fully later. Our map is based upon Dr. Sasse's data in *Tijdschrift Aardrijkskundig Genootschap*, Amsterdam, 1879, pp. 323 *seq.*, supplemented by his later work and that of Dr. De Man. For other authorities, consult our Bibliography under Lubach, 1863; von Hölder, 1880; Folmer; and especially Virchow's *Beiträge zur Anthropologie der Deutschen, mit besondere Berücksichtigung der Friesen*, Berlin, 1876.

stone age. This was stoutly contested not only by the Dutch, but by so eminent German authorities as Von Hölder and others. The research stimulated by the discussion has, I think, controverted Virchow's hypothesis entirely. It is now generally recognized that the majority of these Dutch are Teutonic by descent, not distinguishable from either the Flemish in Belgium or the Germans in Hanover.

The population of Zeeland, with parts of the provinces of North and South Holland and Utrecht, however, including the low islands



Data for this map are corrected from the original skull measurements by adding two units, to make them comparable with other maps based upon study of living heads.

at the deltas of the Rhine, Meuse, and Scheldt, is quite different. Even here, all along the seacoast, the Teutonic characteristics seem to have persisted, probably due to roving bands from the north

similar to those which have settled all along the *litus Saxonicum* in France. But on the inner islands, especially in Nord and Zuid Beveland, there is every indication of a broad-headed Alpine colony of considerable size. This is shown by the dark tints upon our map. An extreme brachycephaly has been proved here by Dr. De Man, who has most courteously sent me photographs of crania reproduced herewith. The long-headed one is from the seacoast, where Teutonic



BRACHYCEPHALIC TYPE. Zuid Beveland.
Cephalic Index, 87.



DOLICHOCEPHALIC TYPE. Coast of Zeeland. Cephalic Index, 78.

characteristics prevail; the other globular one is from a village in the middle of the brachycephalic area, submerged in the sixteenth century. These are each typical; the contrast is too marked to need further comment. There can be no longer any doubt that in these islands a settlement of the Alpine invaders took place at an early time. Lubach nearly forty years ago, long before any precise measurements were taken, commented upon the brunetteness, the stocky build, and the round visage of the peasants of this district. In each of these respects they differed from the Frieslanders further north; who, as we have said, are Teutonic by descent. The nearest blood relatives of these south Hollanders are the Walloons in Belgium and the original broad-headed element in the Danish population. From which of these colonies the round-barrow type invading the British Isles came we may never determine; we only know that the Alpine race touched the western ocean at this spot, and has here persisted in remarkable purity to this day. It seems as if a race had here found refuge in this secluded spot against the aggression of the Teutonic type, just as the Walloons are sheltered in the wooded uplands of the Ardennes plateau in Belgium a little farther south.

To resume once more the thread of our argument after this digression, we may continue to trace the uttermost limits of this broad-headed infiltration into Europe. The whole basin of northern France was overflowed, and the incoming human tide from the east

swept away out to the point of Brittany, where it has held its own to this day. The central plateau of France, in fact, was peopled by it, perhaps for the first time.* The intrusive type seems also to have with difficulty entered Spain, for, as we have shown, the population of the mountainous northwest provinces is even at this present day less purely Iberian in type by reason of it.† One spot alone south of the Mediterranean Sea was perceptibly affected by it; recent evidence from the island of Gerba off Tunis proving such colonization to have taken place.‡ In Italy we are certain as to the extension of the Alpine type down into the peninsula. The existing population of the Po basin was submerged entirely, with the inherited result that the broad-headedness of the peasantry to-day becomes less frequent across Tuscany until it vanishes somewhat north of Rome.§ In the eastern half of Europe the occupation was complete; whether primary or not it is impossible to state. In Austria at least, a long-headed people probably antedated it.|| We only know that the broad-headed Slavic populations extend to-day uninterruptedly across from the Baltic to the Black Sea, apparently becoming purer as we proceed eastward.

What right have we for the assertion that this infiltration of population from the east—it was not a conquest, everything points to it as a gradual peaceful immigration, often merely the settlement of unoccupied territory—marks the advent of an overflow from the direction of Asia? The proof of this rests largely upon our knowledge of the people of that continent, especially of the Pamir region, the western Himalayan highlands. Curiously enough, just here on the “roof of the world,” where Max Müller and the early philologists placed the primitive home of Aryan civilization, a human type prevails which tallies almost exactly with our ideal Alpine or Celtic European race. The researches of de Ujfalvy,[^] Topinard, and others localize its peculiar traits over a vast territory hereabouts. The Galchas, Tadjiks, and their fellows are gray-eyed, dark-haired, stocky in build, with cephalic indexes ranging above 86 for the most part. Be it noted, these people are not Hindus, those whom Max Müller held to be modern representatives of our primitive common ancestor. The Hindus are rather akin to our long-headed Mediterranean race. The basin of the Ganges is as different anthropologically from the Himalayan highlands as that of the Rhône is from the Swiss or Italian Alps. This was emphasized in our world

* Salmon, 1895, and Hervé, 1896, have well summarized the evidence for France.

† Hoyos Sainz and Aranzadi, 1892, and Jacques, 1888.

‡ Bertholon, 1897.

§ Zampa, 1891, is best on this.

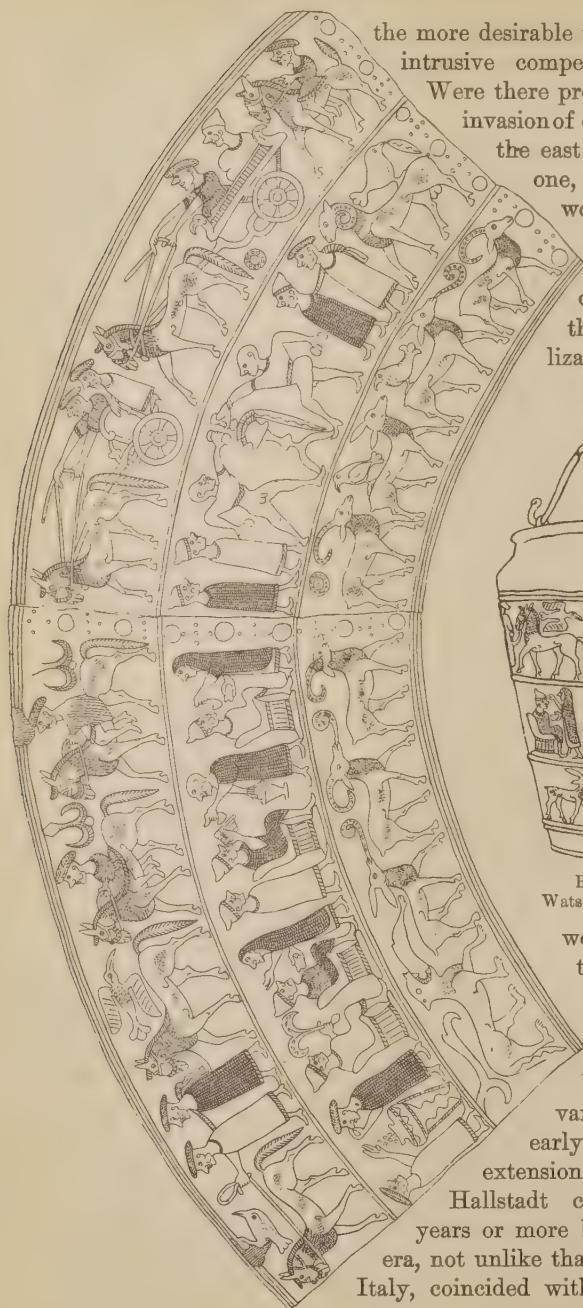
|| Matiegka, 1890.

[^] Les Aryens au Nord et au Sud de l'Hindou-Kouch, Paris, 1896. For other peoples of India, consult Risley.

map of cephalic index published in the March number of our series. Thus do we discover the complexity of the problem. Even if the old philologists were right in tracing European languages to a primitive home in western Asia, a point which is generally denied to-day, there would still be no possible solution as to which of these two Asiatic types were entitled to the name Aryan. Probably the Hindu would have been adopted for this honor; he is kith and kin physically of the Mediterranean race to which the Semites, Greeks, and Romans belong. But how about our proof that this type is the most primitive in Europe, persisting *in situ* from the stone age! Whence came the Aryan civilization then? The question is too broad to be settled here and now. We may return to it later.

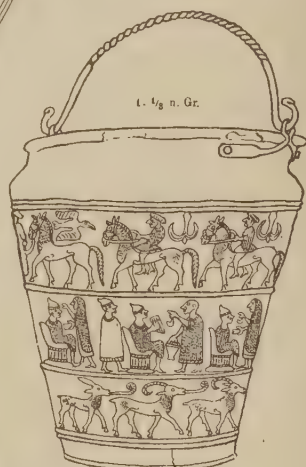
The only point which the discovery of a broad area in western Asia occupied by an ideal Alpine type settles, is that it emphasizes the affinities of this peculiar race. It is no proof of direct immigration from Asia at all. It does, however, lead us to turn our eyes eastward when we seek for the origin of the broad-headed type. The wedge-shaped area of present Alpine occupation in Europe vaguely points to an original ethnic base of supplies somewhere in this direction. It could not lie westward, for everywhere along the Atlantic the race slowly disappears, so to speak. Neither does its original source lie in central Europe, for its greatest representation lies in the Slavic countries east of Vienna and Berlin. That the Alpine type approaches all the other human millions on the Asiatic continent, in the head form especially, but in hair color and stature as well, also prejudices us in the matter, just as the increasing long-headedness and extreme brunetteness of our Mediterranean race led us previously to derive it from some type parent to that of the African negro. These points are then fixed: the roots of the Alpine race run eastward; those of the Mediterranean type toward the south.

Before we leave this question we must clear up a peculiar difficulty. If the Alpine broad-headed race entered western Europe with sufficient momentum to carry it clear across to the British Isles, up into Norway, down into Spain, intruding between and finally separating the more primitive long-headed population into two distinct groups, why is it everywhere to-day so relegated to the mountainous and infertile areas? This is especially true wherever it comes in contact with the Teutonic race in the north. It is one of the most striking results of our entire inquiry thus far, this localization of the Alpine type in what we have termed areas of isolation. One is at a loss to account for this apparent turning back of a tide of prehistoric immigration. The Teutonic race must once have yielded ground before the invader; our prehistoric stratification shows it. Why has it now turned the tables and reoccupied all



the more desirable territory, driving its intrusive competitor to the wall?

Were there proof that the original invasion of our Alpine race from the east had been a forcible one, an answer to this would be afforded by a study of culture; for it is now accepted generally that the main arts of civilization have entered



BRONZE SITULA.
Watsch, Austrian Tyrol.

western Europe from the east. Moreover, the present seat of the Alpine race was characterized by a peculiarly advanced civilization in early times. Thus the extension of the so-called Hallstadt culture a thousand years or more before the Christian era, not unlike that of the Etruscan in Italy, coincided with the territory now

distinctly Alpine by race. The character of this culture, its manners and customs, and its skill in the arts, are shown by the accompanying cuts.* This is a reproduction of the design upon a bronze "*situla*" or vessel found at Watsch in the Austrian Tyrol in 1882. A culture capable of such work as this, and possessed of such a civilization to represent, centered in the eastern Alps at a very early time. We are assured, moreover, that the people were overwhelmingly Alpine in racial type. Study of upward of one thousand crania from their graves has made this certain.† At the early period when this culture flourished, Scandinavia and Britain were probably in a far lower stage of civilization. Hence if, as we say, the invasion by the broad-headed race had been by force of arms, every advantage would have been on the side of the more civilized race against the primitive possessors of the soil. The clew to the situation would have lain in the relative order in which culture was acquired by the competing populations. It would then have been possible that the Alpine invaders, penetrating far to the west by reason of their equipment of civilization, would have lost their advantage so soon as their rivals learned from them the practical arts of metallurgy and the like. Unfortunately for this supposition, the movement of population was rather an infiltration than a conquest. How may we explain this?

Our solution of the problem as to the temporary supersession of the primitive population of Europe by an invading race, followed by so active a reassertion of rights as to have now relegated the intruder almost entirely to the upland areas of isolation, is rather economic than military or cultural. It rests upon the fundamental laws which regulate density of population in any given area. Our supposition is this: that the north of Europe, the region peculiar to the Teutonic race to-day, is by nature unfitted to provide sustenance to a large and increasing population. In that prehistoric period when a steady influx of population from the east took place, there was yet room for the primitive inhabitants to yield ground to the invader. A time, however, was bound to come when the natural increase of population would saturate that part of Europe, so to speak. A migration of population toward the south, where Nature offered the possibilities of continued existence, consequently ensued. This may have at times taken a military form. It undoubtedly did in the great Teutonic expansion of historic times. Yet it may also have been a gradual expansion—a drifting or swarming forth, ever trending toward the south. We know that such a migration is now taking place. Germans are pressing into northern France as they have

* Consult our Bibliography for a full list of authorities by von Sacken, Hochstetter, Hoernes, Chantre, and others. Ranke, in *Der Mensch*, gives a good account of it.

† Zuckerhandl, 1883, pp. 93 *seq.*

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always done. Swiss and Austrians are colonizing northern Italy; Danish immigration into Germany is common enough. Wherever we turn we discover a constantly increasing population seeking an outlet southward. The ethnic result has been therefore this: that to-day the Teuton overlies the Alpine race, while it in turn encroaches upon, submerges the Mediterranean type. Thus do economic laws, viewed in a broader way, come to the support of ethnic facts. Other problems concerning population are immediately suggested. These we shall consider in the next and final paper of our series.

THE KING OF THE WOODS.

BY NORMAN ROBINSON.

VERY few persons ever visit the southern portion of the United States and become at all familiar with its woodland life without being captivated by that prince of singers, the mocking bird. Not only as a musician, but in general "smartness," he is far and away ahead of anything else that flies. He is the "Yankee" among birds. In vivacity, in cleverness, in a quick and dexterous use of his small but brilliant brain, it would be hard to point out his equal. And when in the springtime the woods resound with his clear, flute-like, and exultant notes, even the man, if such there be, "who hath no music in his soul" would find it hard to resist the contagious good humor of his glad and gleeful song.

And yet the mocking bird (*Mimus polyglottus*) is incorrectly named. He is by no means a natural mimic. Half a dozen birds could be mentioned that in this particular far surpass him. This may seem a very strange thing to say, in view of the stories current so abundantly illustrating and emphasizing this supposed gift.

Professor Chandler, in a notable case in a Boston court, once remarked that it was practically impossible for most people to tell the truth even if they tried. Especially is this the case in observing scientific phenomena by persons not trained in that special field. Imagination often plays strange tricks with the recording cameras in such excited brains. As an illustration bearing upon the case in point: A lady had a beautiful grove of young oaks in her front yard of several acres in extent. It was fairly alive with mocking birds. It was in the springtime at their first nesting season, and many of the young birds were beginning to try their wings. One morning Jim, the lazy old tomcat, was missed from his accustomed corner on the sunny porch, and soon was heard a chorus of confused and strident cries issuing from the back part of the grove, and there came Jim

scampering toward the house, pursued by half a dozen or more of mocking birds. They were darting down upon him and pecking at him from all directions, with special reference to putting out the eyes of the now thoroughly frightened cat, while from their angry little throats all the while was pouring forth a torrent of bird "billingsgate" that could hardly have been excelled by "our army in Flanders." At the dinner table this lady gave a very graphic account of how the tables had been turned on Jim. "But the most singular thing of all," said she, "was that when those mocking birds were pecking away at the eyes of that poor cat, they were all crying 'Scat, scat, scat!'" The mocking bird has an angry note consisting of the syllable "ka-a," with short *a*, sharply and rapidly repeated, and it required no great effort on this lady's part to put an *s* in front of the *k*, especially as there was the cat running for dear life, and the confused cries of his winged pursuers did have a great deal of resemblance to the tones of a woman who has surprised pussy with her head in the cream jug.

The fact is that this southern songster has naturally a very extensive repertoire of sounds, most of them musical, to which he seldom adds a new note, and which he generally arranges in pretty definite order. Among these sounds not a few more or less resemble the songs or cries of our common forest birds. It does not require so very vigorous an imagination to transform what is simply the natural note of the mocking bird into a very fair imitation of his less gifted neighbors. That there is any conscious or intentional mimicry about it, facts go to disprove. An isolated bird will sing his own notes and imitate songs he never heard. So, too, with the mocking bird's supposed imitation of the "miew" of a cat, the cry of a chicken, etc., they are all alike the natural notes of the bird plus a little imagination, which the circumstances supply. In point of fact, the mocking bird is a very dull pupil when you attempt to teach him any new musical sounds or combinations of sounds. Whether it is because he "knows it all" already, or is indifferent to new music, the fact remains. One bird, a beautiful natural singer, received patient teaching at night in an unlighted room for a month before he seemed to be trying in an awkward way to imitate the notes of his instructor. It was very much "mixed," but it was clearly an attempt at his lesson—the first five notes of "Rory O'More." This was encouraging, and showed that an impression had at length been made upon the tiny brain. Efforts were redoubled, and at the end of three months the bird could whistle fairly well the first two bars of the song. Still he not infrequently made mistakes, forgot his small "score," and was by no means a success as a singer of anything but his own natural and inimitable songs.

As a household pet the mocking bird is simply delightful. If taken young and reared in a cage he becomes very tame. He will fly to your knee, eat from your fingers, perch on top of your head, jump down to your shoulder, pull your whiskers, if you have whiskers, give you little love taps on your cheek, and in a hundred cunning ways evince his sociable and friendly disposition. He loves to get out of his cage and fly about the room, and if there are no cats about seldom attempts to fly out of the window. One caution, however, is necessary. A bit of cloth or a thread is a great find for a mocking bird. He will spread out his wings, flirt his tail, cock his eye, twist and turn his quick little head, and shrug his shoulders in a comical pantomime of astonishment. Then he will dart to some desk top or chair round, and the first you know he is swallowing it. A few such experiences are disastrous.

In New York there is one of these wonderfully gifted little pets named Peter. He is just four months from the nest, and was taken from Florida with several others before the stringent laws protecting song birds were promulgated. He has already his Maltese coat and new tail, and is in every respect a precocious bird, not only equaling in song many a full-grown singer, but rivaling the best of them in amusing antics and in genuine intelligence. He takes the end of a piece of thread tied to a spool, jumps over his perch to the floor, and keeps this up till he has wound all of the thread on the perch, and has the spool suspended in the air. Then that game is done. He next takes a corner of the clean white paper that is put into his cage to cover the floor every morning after his bath, and with his beak persistently rolls it up like a carpet, and leaves it at one end of his cage. He opens the latch of his door and walks out whenever he pleases.

Here in Orlando, Florida, the mocking birds are far the most numerous birds. They are now protected by the most stringent laws. To kill, catch, or even keep one in a cage, is an offense punishable by heavy fine and possible imprisonment. In a short space of time the result is that they have multiplied wonderfully, and are just about as tame as chickens. They frequently fly into the kitchen, and have been known sometimes voluntarily to enter a cage in pursuit of food.

One of the most interesting traits of these birds is their fearlessness. In defense of their supposed rights, and especially in protecting their young, they will fight anything from a dog to an elephant. One reason probably why the English sparrow has never obtained much of a foothold in the South is because some mocking-bird congress has passed "bird immigration laws," which positively shut out this pestilent and aggressive European intruder. "Bobwhites,"

blue jays, woodpeckers, shrikes, and the beautiful little mourning doves, the smallest known species, and other varieties less frequently seen—all seemingly have perpetual treaties of peace with the mocking birds. The only one that gets into a “scrap” with the “boss of the forest” is the shrike, a short, chunky little fellow, about the size of the mocking bird, and with a powerful beak with which he delights to impale small animals upon orange thorns. One would suppose that the mocking bird would be in deadly fear of this little feathered bully. Not a bit of it! Other birds may run from the shrike, but he doesn’t. Both love to build their nests in the orange trees, and there are frequent questions of “squatter sovereignty” to be settled by beak and claw. Whether by lung power or muscle, in the final “compromise” the shrike always goes to another tree.

As to the morals of this little past master of song, the truth must be told, he has no respect for the eighth commandment. He is a thief, a cunning, inveterate, unscrupulous “conveyer” of other people’s property. Peaches, grapes, strawberries, figs, Japan persimmons, Surinam cherries, Catley guavas, are to him legitimate plunder. With the exception of oranges, bananas, pineapples, and ordinary guavas, which he never touches, nothing is safe from his depredations. Scarecrows don’t even amuse him when he has made up his mind to sample fruit. He is a capital judge, too, and always selects the largest, ripest, and most juicy specimens for his repast. No economic considerations trouble him either. He takes a bite here and a nibble there, and ruins twenty times as much as he consumes. Bagging fruit is no protection, for he only tears the bags to pieces and helps himself. Even vines and fig trees incased in mosquito netting are not secure; the little marauder will get in somehow and complacently take what he wants.

Yet, in spite of all this, the benefits received by the south land from this cunning little giver of sweet sounds and lover of sweet fruits vastly outweigh all the damage that he does, however vexatious it may be. Bugs and worms and creeping things swarm here the year round. The mocking bird is essentially insectivorous. His “steady diet” consists of the enemies that the horticulturist and the fruit grower have most occasion to dread. He takes his fruit by way of dessert, and has fairly earned it like a good boy by eating first a substantial dinner.

A BERZELIUS museum is to be established by the Swedish Academy of Science, with funds provided by Prof. Hj Sjorgen. It is to hold all the objects formerly contained in the laboratory of the great chemist—which are now scattered in various places. In connection with it a list of all the works and treatises of Berzelius is to be compiled.

SCIENCE AND MORALS.

BY P. M. BERTHELOT.

SCIENCE, held under the ban through the long course of the middle ages, has now conquered its independence, by virtue of the services it has rendered to man. It has fulfilled the promises made in its name by the natural philosophers of the seventeenth and eighteenth centuries, and has transformed since then, as it has indeed been doing from the beginning, the material and moral conditions of the lives of the people. The changes accomplished from the beginning of civilization have had a most effective promoter in science, although its real importance was long hidden or obscured by the mixture of elements borrowed from the imagination. For two centuries and a half only has the scientific method been disengaged from all strange alliance, and been manifest in its purity; its efficiency has been attested in the most various ways by a constantly accelerated industrial and social evolution.

There exist, indeed, and always will exist, many deplorable things, much suffering, and much wickedness in the world; but it is to the credit of science that, instead of lulling mortals with the feeling of their powerlessness into the passivity of resignation, it has urged them to react against destiny, and has taught them the sure way by which they can diminish the sum of woe and injustice, and increase their happiness and that of their fellows. It has not accomplished this by means of verbal exhortations or *a priori* reasoning, but by virtue of processes and words really efficacious, because they are acquired from the study of the conditions of existence and the causes of evils.

The words mystery and miracle are alike excluded from scientific language and methods, not by virtue of purely logical deductions, but because wherever it has been possible to take deep soundings of phenomena we have found that they were constantly produced in accordance with a determined relation between effects and causes. It is exactly this *a posteriori* determination that constitutes the scientific method. We do not, indeed, pretend to say the last word concerning the universe. We profess, on the contrary, that that word can not be formulated in advance, and we know that among the infinite variety of phenomena we never succeed in meeting and observing more than the most infinitesimal part. We know the whole extent of our ignorance, and have the modesty consonant with it, but it should not be represented by a universal skepticism; no more should it cause us to depend upon the existence of supernatural verities, and paralyze our efforts to the profit of mysticism. The

scientific method has been recognized, by the experience of ages that have passed as by that of present ages, as the only efficacious method of arriving at knowledge. This is the significance of the exclusion of mystery in the study of man and the universe, and in the government of individuals and societies, which is, or rather ought to be, the consequence of this study. The mystic who assumes to direct his life and business according to the ideas of the marvelous would very soon be lost; general history and mental pathology show that peoples and persons who have adopted mystery and divine inspiration as exclusive guides have been precipitated at once into irreparable moral, mental, and material ruin. We may, then, leave the mystics to enjoy their dreams, but must not permit their intolerance to impose these dreams upon us as the rule of social activity. Man has, indeed, always sought to escape the severity of determinism in this way, just as he formerly tried to impose his will upon the superior powers by the conjurations of magic, or to turn aside the rigor of destiny by incoherent prayers. But such illusions need not make us depart from the rigor of our method of proceeding, or be allowed, by an irrational confusion, to destroy the exactness of our results. This irrevocable separation between the scientific method and mystery has not always been; it is the product of a long elaboration, in which empirical and experimental conceptions have been associated and confounded. For better comprehension, let us try to summarize in general outline the historical evolution of science. In all things we can best comprehend the present by going back to the beginning.

Let us carry ourselves back to those distant periods during which our species was gradually disengaging itself from animality. We can do this to a certain extent by the aid of archæological discoveries, and by comparing them with the stories of travelers who have observed savage tribes which have been arrested at different steps of the evolution that has been accomplished since the primitive ages by civilized peoples. Thorough examination of the habits and instincts of animal species, knowledge of the laws of the psychological and physiological development of the individual, especially in his infancy, unite with history to cast a strong light on the problems with which we are here concerned. The sum of these studies has shown how the human races, each according to its degree of intelligence, have gradually created the instruments, arms, and customs by the aid of which they achieved their first triumphs over Nature and accomplished their first organizations. The family and the state, morality and virtue, gradually issued from the social instincts which we see in action, now, as formerly, among the animal races.

The intelligence of the first men was too feeble, however, to conceive either the abstract laws of their own development or those of

natural phenomena. It personified them; it made realistic beings of them, constructed in its own semblance—that is, souls and gods. Such is, in fact, the universal tendency, as has been established by travelers among savages. Our own children, too, are prompt to transform their joys and their fears into superhuman phantoms. The images of dreams serve them as guides in this respect. In a word, observation shows that men are drawn by a spontaneous inclination to give objectivity to the products of their own thought, in order to create personalities and symbols, to which they shortly assign an absolute character, autonomous and divine. In this way, at the origin of the civilizations, every invention, every organism, was attributed to celestial revelations. The most intelligent and best instructed men founded their domination on such prepossessions, which they shared in, too, and when the temples rose at Memphis and Babylon, all knowledge was concentrated around their altars. The same persons, protected by their sacred character, then represented science and religion. The two orders of ideas were confused into a common dogmatism. A similar condition was reproduced at the beginning of the middle ages, after the destruction of the ancient civilization by the barbarians.

Hence the singular character of these primitive sciences, like astrology and alchemy, in which positive results were associated with the dreams of magic, and in which the efficacy of experimental practices had to be assured by the use of formulas and incantations, intended to control the will of the gods and command their assistance. Miracle was then obligatory upon the divinity, and independent of all moral notions. The Greek philosophers first tried to disengage true science from this alliance and render it purely rational. They, too, were at first accused of impiety—an accusation which has not ceased to be sounded for two thousand years, and which has cost the lives, from Socrates down, of the purest and most disinterested men. Yet, Greek genius, with all its power, never reached a clear apprehension of the scientific method, as we apply it now in the study of the world and of man. That method was not distinctly separated from pure and established logic till the seventeenth and eighteenth centuries, during which period the experimental sciences and the sciences of observation—physics, astronomy, mechanics, chemistry, physiology, and natural history—were definitely constituted. The method has been since extended to the historical and sociological sciences, in place of the old systems—the issue of the theology of the middle ages. We add, finally, that it is only in our own time that the scientific method, which looks to the relative and excludes the absolute, has begun to be fully applied and extended to ideas of every order.

Science presents itself to us under a double aspect: as primitive science, which is the solid basis of every application, in the material as well as in the moral domain; and ideal science, which comprehends our near hopes, our imaginings, and our remote probabilities. The common bond between these two aspects is method. Our method consists in first observing facts. I mean internal facts, revealed by consciousness or inner sensation, as well as external facts, made manifest by outer sensation; and in provoking the development of both by experiment, the principal source of our discoveries. This method is the same for social and political, for material and industrial facts. The study of facts thus constitutes the point of departure for all knowledge. When facts are once established, human intelligence brings them together and seeks to determine general relations between them. Hence, what we call scientific laws; and upon these laws rests all application of science, to individuals as well as to societies.

But this pure determination of facts and their laws does not satisfy the human mind. Drawn by an invincible tendency, it supports itself upon the facts and rises above them to construct representatives or symbols, by the aid of which it collects its knowledge into a co-ordinated system of hypotheses. Such a system is even indispensable if we would go further and make discoveries; for, in order to find new facts and new relations, it is necessary first to imagine them; then we seek for the realization of them. Each one develops as he will, following his individual inspiration according to his feelings and creative faculties, the consequences of the conceptions and symbols by the aid of which he has figured facts and laws to himself. But the student also should always be ready to abandon his hypothetical beliefs as soon as the facts have demonstrated the vanity of them. In any case, every one finally builds up thus his system of the world—a scaffolding, resting at the bottom on facts, but the solidity of which—I mean the certainty, or rather the probability—diminishes as one goes higher.

Thus facts and laws, through symbols and hypotheses invented to co-ordinate them, constitute the fundamental basis and even the sole substratum of every system. Such are to-day the general views, such the manner of proceeding, of those who seek to raise the scientific ideal above empiricism.

The diversity, the profound contrast existing between the scientific and the theological methods employed in the seeking for truth are manifested to a very striking degree in the application of these methods to the government of individuals and of states. While theologians erect their systems regarding the beginnings and the ends of things into absolute and invariable principles revealed by

the divinity of whom they declare themselves *a priori* the organs, and while they assume to impose them, even by force, as the eternal rules of private and social life, men of science, having recognized the relative and historical source of these assertions, limit themselves to applying actual rules to the practical conduct of life, in morals and politics as well as in hygiene and industry—rules always provisional, and subject to modification from day to day by the evolution of future ages, as they have been constantly modified in past ages.

The prime characteristic of modern science is its readiness to declare the increasing uncertainty of its ideal constructions. While it does not refuse to examine problems of origin, while it itself furnishes the only probable data by the aid of which the solution of them can be pursued, it affirms nothing and promises nothing in the matter. It would consider it equally rash to set up on similar constructions the rules of industrial applications and moral rules for the conduct of individuals and societies. In real things we never proceed in the name of absolute principles, because we have learned that all our principles rest upon hypotheses borrowed from the facts of observation under a direct or simulated form. To deduce everything from absolute principles is an illusion. Whatever pretends to be supported on the absolute is supported on nothing.

Man's knowledge is gained solely by the method of the observation of facts, but is derived from two sources, an internal and an external one. Sensation reveals the external world to us, and is the point of departure of all the physical, natural, and historical sciences. It exhibits the insignificance and subordination of the individual in mankind, present and past; the insignificance and subordination of mankind overwhelmed and almost reduced to nothing in the infinite whole of the universe. From this point of view, all morals consist in our humble submission to the necessary laws of the world; religions say nothing more than this when they subordinate the human mind to the divine will. In this domain everything is objective.

In the inner world, that of consciousness, on the contrary, the man appears alone; his mind, his feelings, become the measure of things. These have no existence for us, except on the condition that they are known, and therefore from that point of view they exist only for our intelligence and in our intelligence. In this domain all is subjective. Such is the contrast—I do not say opposition—between the two sources of our knowledge. Now, these two sources, internal and external, of our positive knowledge are equally, I repeat, the two sources of our morals.

Human morality, no more than science, does not recognize a divine origin; it does not proceed from religions. Its rules are drawn from

the internal domain of conscience, and the external domain of observation.

The man of our time finds in the depth of his consciousness the idea of good and evil, and the ineffaceable feeling of duty that is the categorical imperative of Kant. Duty is further conceived as toward himself and toward other men—that is, he comprehends the solidarity of his relations. These are fundamental facts of consciousness, independent of all theological or metaphysical hypothesis. The ideas acquired from the exterior source of our consciousness—that is, from history and the natural sciences—present morality under a different light, in that they show the instinctive origin and the evolution of it. The human species, in fact, only represents a particular case among the multitude of animal species that live in society. With these we witness, according to the degree of perfection they manifest, the appearance of the first elements of morals. The family, offspring of the instincts that preside over the preservation of the species, exists, temporarily at least, among birds and mammals, not to go lower. It coexists with the feeling of maternal love, and in certain cases of paternal love, raised to the highest degree.

With the feeling of the family we meet also, among the social species, that of solidarity and the devotion of the individual to the collective whole, rising sometimes to the sacrifice of his life. The study of the still savage human races has shown how near their special morality lies to that of the social animal species, if it is not even inferior to that of some of them. There are, in this respect, great differences in the social instincts, among men as well as among animals. But the existence of a general basis common to both is demonstrated by observation.

The social instincts, and the feelings and duties derived from them, are not, then, peculiar to the human species, and due to some strange and divine revelation, but are inherent in the cerebral and physiological constitution of man—a constitution similar to that of the animals, but of a superior order, and having become more so during the course of centuries by the effects of the conquests of our intelligence. The hereditary perfection of these instincts is the real basis of morals, and the point of departure for the organization of civilized societies.

As men advanced in civilization, their positive knowledge, continually increasing, demonstrated the social utility of certain duties and certain moral laws, which were rendered obligatory by the chiefs of the states—priests and legislators. But these laws, deduced from scientific notions, were associated and in a manner amalgamated with the arbitrary prescriptions of the theocracy, and proclaimed according to mystic formulas, from which no mind was then free.

The history of the religious formations and evolutions that have succeeded one another among mankind for seven thousand years shows that there exists no genetic bond, no necessary relation, between morals and mysticism. With nations as with individuals, the least moral personalities are often met among the most religious. In short, history proves that the development of morals in the world has been connected at the same time with science, from which it has proceeded; and with religions, which have rested upon it as one of their points of support. But no more from the external point of view of history than from that of internal consciousness have morals been the product of religions. The same representative illusion always appears, which transforms into the generative cause of certain ideas the notions that have issued from them.

The modern conception of morals is of a generous and universal character. It rises with the elevation of intelligence; its practical applications are more or less delicate, according to the sentiments variously developed by peoples and individuals. But it responds to-day, as it has always responded, to the condition of knowledge as it is more or less advanced according to time, places, and persons. Therefore it could not continue fixed in any decalogue. It undergoes gradual modifications with the continual discoveries of the physiological, psychological, and sociological sciences. Just as there exists by the side of positive science an ideal science, derived from it, moreover, but which precedes it and incites it forward, so there are ideal morals, which announce and precede the evolution of future morals. These ideas, this conception of modern morals, are becoming every day more preponderant, and if they have not yet been accredited by men as established science, it is because of the long religious servitude that has been imposed on education. Down to our own time it has been the practice to base the moral education of the people and the rules of conduct on the catechism—on theological doctrines and prescriptions—instead of establishing them upon positive data acquired from consciousness and the historical and natural sciences.

We now see every day how the application of scientific teachings to industry is continually adding to the wealth and prosperity of nations. The application of the same teachings to hygiene and medicine is constantly diminishing the pains and risks of disease, and increasing the mean duration of life. The history of the present century likewise demonstrates to what point the lot of all, including the poorest and most humble, has been ameliorated by the new ideas; while we must not lose sight of the fact that we are still far from having reached the degree of improvement that modern justice and morals demand, which we should all strive to attain. Such are some

of the consequences of the scientific method—consequences which we are pursuing and shall realize, in the moral as well as in the material order, and despite all opposition; and in this way will come the universal triumph of science to assure the highest degree of happiness and morality to men.—*Translated for the Popular Science Monthly from the Author's Science et Morale.*

FEET AND HANDS.

By M. BERNARD (Mrs. HENRY BERNARD).

I.

IN the great family of the backboned animals, to which we ourselves belong, many different kinds of feet and hands are to be found, their shape showing a very wonderful relation to the manner of life of their possessors.

We are not going here to describe the fins of fishes, although many people believe that our feet and hands were developed from fins; we shall only deal with the true feet and hands found in animals higher than the fishes.

When we try to picture the foot or hand of any animal, we naturally think of it as we see it, often covered with fur which to a great extent hides its real shape. In our own feet and hands the true shape is more evident because the skin has lost its hairy covering. To obtain a clear idea of the feet and hands of different animals it is therefore better to limit ourselves to the bones which give them their firmness.

However different feet and hands may be, there is a certain remarkable similarity of plan in them all. In all, as in our own, there is a cluster of bones forming an “ankle” or a “wrist,” and then running out from this a certain number of what we may call “rays.” In each foot and hand there were once five rays, as there now are in our own, but in many animals this original number has been reduced, as we shall see. Each ray consists of several joints; the first joints are the longest, and are bound together by skin and flesh to form the sole of the foot or the palm of the hand, while the other joints form the free toes and fingers, the skin at their tips carrying nails or claws.

We can all trace this general plan both in our own feet and in our own hands, although in outward form our feet do not resemble our hands, and the work they have to do for us is so very unlike that it may seem surprising they should be built upon the same plan.

The explanation of this similarity of plan is very simple. Once,

very long ago, there was no difference in the work done by feet and hands; they were all used for walking, and were thus all, properly speaking, feet. So if we want to understand our feet and hands we must go back to animals which had four feet and no hands, the four feet each having five toes.

Fig. 1 is a drawing of the foot of a crocodile, which is probably not unlike the earliest kind of foot. At the end of the leg bones A and B we see several small bones, and, starting from these, five jointed rays which in the natural position lie flat on the ground. The fore feet and hind feet of the crocodile are almost exactly alike, having the same work to do—i. e., helping the animal to shuffle along the ground. This kind of foot is very well suited for reptiles, such as crocodiles and lizards, which lead a more or less lazy life, merely moving from place to place to find a patch of sunshine to lie in, or a spot which the animals or insects they feed on frequent, and where they can be snapped at easily. Some of these animals, it is true, are capable of darting at times with lightning speed, but this they seem to do by the help of their tails.

The clumsy, shuffling way of walking on the flat of the foot has been given up by most animals, but we still find it in some, such as the bears, which are called plantigrades or sole-walkers because of their flat-soled feet. The feet of the bear are very superior to those of the crocodile, for they are armed with claws which help him to hold prey and to climb trees; but his awkward, shuffling gait shows pretty plainly that the method of moving on the flat sole is not the best possible for running.

A better method of running is found in most of the higher animals, which no longer touch the ground with the sole of the foot, but only with the toes or digits, and are therefore called digitigrades or toe-walkers. Fig. 2 is the foot of a doglike animal (the wolf), and Fig. 3 is that of a catlike animal (the lion), and in both of these we see that the part of the foot which in ourselves we call the heel does not lie on the ground as in the crocodile or the bear, but is raised high above it, so that the animal walks, as we have said, on its toes or digits. The reason why this is a better method of running is that it gives extra length to the leg. A longer leg means a longer stride and greater speed. The wolves, hyenas, and foxes, which are doglike animals, and the lion, leopard, lynx, and all other catlike animals are beasts of prey—that is, they eat other animals which they have to hunt—and all in their turn are liable to be hunted, so they need to be able to run very swiftly. Many of the catlike animals, too, depend, both in attack and defense, quite as much on springing as on running, and so need to be very agile. For both running and springing we ourselves even use our toes and not the soles of our feet,

and these animals, with whom running and springing have become a constant habit, have come to use only their toes always; the heel no longer touches the ground except when the animal is crouching.

Now, in the foot of the crocodile (Fig. 1) it is seen that all the toes are not of the same length. If animals with such feet began to walk on their toes, some would not touch the ground. This, indeed, is what we find in many animals, especially in those cases where running is all that is required. In the feet of the dog, for instance,

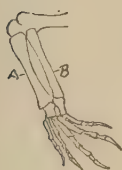


FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.

only four toes touch the ground; the fifth toe, having long been less used than the others, has become very small. In the hind feet, which are used exclusively for running, the remains of the fifth toe can be felt as a small projection under the skin, some way up the back of the leg. In the fore foot of the dog, however, it is a distinct toe, with a nail, which is still used for digging.

In cats and dogs, as in the bears, claws are well developed. In the dogs they are short and hard but not very sharp, and are used chiefly for digging. The catlike animals, on the contrary, have very sharp, hooklike claws, which are of great use in seizing and holding prey.

It is obvious that if an animal, changing still further its method of walking, took to running on the tips of its nails or claws instead of on its toes, it would have a still greater length of leg, and therefore would be still better fitted for running swiftly. This remarkable manner of running is actually found in most of the swiftest four-footed animals, such as the horses and deer, and also in the cows, the sheep, and the pigs, which are therefore called ungulates, *ungula* meaning a nail. All these animals feed chiefly on grass, of which they need great quantities to nourish their usually large bodies. To obtain constant supplies of grass, in a wild condition, they have continually to roam from place to place. Their feet are admirably suited for these roaming habits, and also for very swift running, which is their best chance of escape from their enemies, the flesh-eating wolves, tigers, etc.

The foot of the bison (Fig. 4), in which the tips of only two toes

touch the ground, shows very clearly the position assumed by the bones of the foot in these animals. Not only are the heel and the first long joints raised above the ground, as in the dogs and cats, but the two remaining long upper joints join together to form one strong bone (Fig. 4 *), and none of the lower joints of the toes touch the ground. The nails of two toes which form what we call the "hoof" rest upon it, while at *a* we see all that is left of a third and fourth toe, possessed by the distant ancestors of the bison.

The chief distinction between the feet of the different nail-walkers is the number of toes whose nails form the hoof. Fig. 5 A shows us that the pig has four toes, but only two touch the ground and make the hoof; the other two are useless, and are gradually becoming smaller. The rhinoceros (Fig. 5 B) has only three toes, and these are not all equal in length, but all are in use and end in massive hoofs. The cow (Fig. 5 C) has only two toes, the upper joints of which have grown together into one as in Fig. 4 (for the bison is one of the cows) so as to form a long, strong part of the leg, the two very

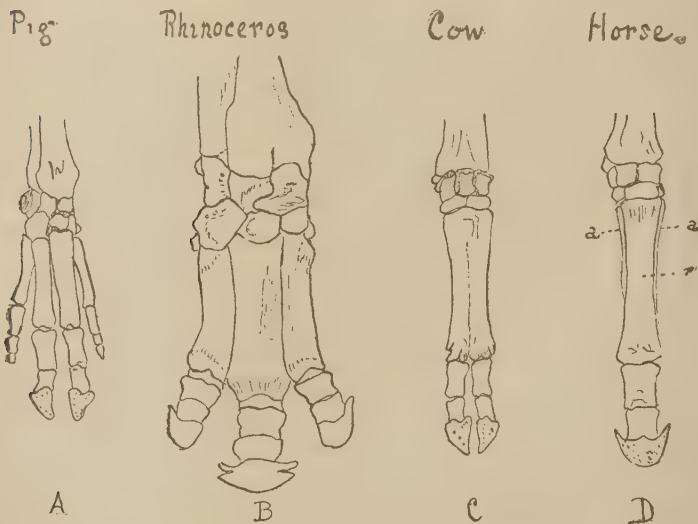


FIG. 5.

thick nails making a double hoof. This is what is called in the Bible a "cloven" hoof; it is not, however, as was supposed, a single nail split down, but two distinct nails belonging to two toes. Then, lastly, the horse (Fig. 5 D) has lost all its toes except one, which has become exceedingly thick and strong. The horse on its four feet, each ending in only one toe with its great nail, attains immense speed in running, great length being given to its stride by the length-

ening out of the one bone (*), which remains as the representative of the "sole" of the foot. Ages ago, as is proved by fossil remains, the forefathers of the horse of to-day had three, four, or even five toes. At *a, a*, on each side of the great single bone two thin bones can be seen. These two bones are the splint bones, the only remains now to be found of the vanished toes.

All the animals we have so far mentioned have four feet more or less alike, all being used for the same purpose, that of running. But some animals came to use their fore feet for one purpose and their hind feet for another, and in consequence of this the fore feet came to be unlike the hind feet.

A striking example of such a difference in the use of the fore and hind feet, leading also to a difference in their structure, is found in the kangaroo, an animal which is seen wild only in Australia, where it hops or leaps over the open country, more or less upright, with extraordinary swiftness by means of its hind feet alone. When it rests, it sits on the long soles of its hind feet, steadied by its thick tail. Fig. 6 A represents the hind

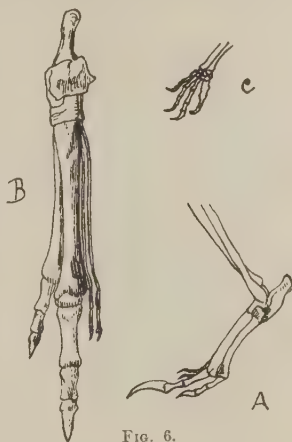


FIG. 6.

foot of a kangaroo in its ordinary position when leaping, and Fig. 6 B shows of what strangely changed bones it is composed. One ray has become very long and thick, and another, though not so long, is also fairly thick, but the other two are quite thin, as if they were dying away from not being used.

The fore feet of the kangaroo (Fig. 6 C) are never used as walking feet except when the animal is hobbling about slowly. Their chief work is grasping and tearing the leaves, grass, or fruit, or digging up the roots which form the food of the kangaroo. They are never needed to support the weight of the body, and so the toes are not large and thick, and four of the five toes are kept. In looking at the fore feet of the kangaroo one is tempted to call them "hands," for this very interesting difference in the use of fore and hind limbs in other animals, such as the monkeys, gave rise gradually to a true grasping hand.

In a second paper we shall deal with the extraordinary transformations of the fore feet into paddles and wings, found in whales, bats, and birds, and shall also see how true hands came to be developed in monkeys and in man.

CARL LUDWIG AND CARL THIERSCH.*

BY PROF. WILHELM HIS.

GENTLEMEN: Our medical faculty, as well as the whole University of Leipsic, were plunged in deep sorrow at the beginning of the term. In the course of a few days we lost Carl Ludwig and Carl Thiersch, two members of our academic association who for years past have been accounted among its ablest supporters. The death of these two eminent men brings to its close a period prosperous and brilliant for our faculty, during which a circle of talented and congenial companions worked harmoniously together. One after another during the past eleven years has left us—Radius, Cohnheim, Wagner, Coccius, and Braune—the younger men in some cases before



CARL LUDWIG, Professor of Physiology, University of Leipsic. Born, December 29, 1816; died, April 23, 1895.

the older; and now two have followed whom we have always held in the highest honor, and without whom we could never have imagined our faculty as existing. An academic memorial service on such an occasion needs no further justification.

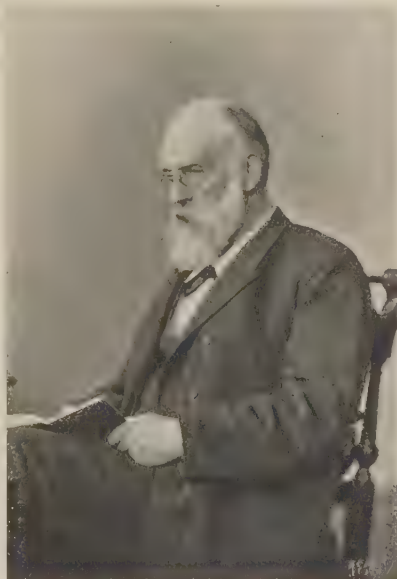
In the life of our universities, in spite of all seemingly uninterrupted activity and the continual substitution of failing powers by new and vigorous ones, a decided periodicity of development makes itself felt. In the whole university and in all the faculties, periods of rest and retrogression follow those of intellectual progress. External and internal conditions combine in producing this result, and it is not always easy to understand the influences

at work. One fundamental condition, however, must necessarily be fulfilled in order that a corporate body may flourish: the body must have strong and clear-sighted leaders, who can direct its activity in definite channels, and insure a unity of purpose in all the departments.

Our faculty has had one of these leading spirits for several dec-

* Memorial Address. Translated by Ethel Bowditch.

ades in the person of Ernst Heinrich Weber, who in 1821 became professor of anatomy, and later (in 1841) also took the position of professor of physiology. His powerful personality has left its traces not only in the proceedings of our faculty, but still more noticeably in the sciences he represented and whose scope he extended in no small degree. Ernst Heinrich Weber, assisted by his brother Eduard, bore the double burden of the two important branches until 1865. In that year, however, it was decided to build a new physiological institute, and Weber, feeling that he no longer had sufficient strength to undertake the new duties that would now devolve upon the professor of physiology, decided to keep only his original position of professor of anatomy. Thus at Easter, in 1865, Wunderlich being at that time dean, Carl Ludwig was made professor of physiology and director of the new physiological institute.



CARL THIERSCH, Professor of Surgery, University of Leipsic. Born, April 20, 1822; died, April 28, 1895.

In these changes the royal government took the initiative. At the request of their noble ruler, King Johann, the far-sighted leaders of the ministry, Secretary of State von Falkenstein and Geheimrath Dr. Hübel, had undertaken the task of raising the University of Leipsic to new importance and splendor with all the means at their disposal. The physiological laboratory was planned as the first of a series of new constructions, the final object of which was to be a complete revolution of the entire system of scientific instruction. In the choice of Professor Ludwig the royal government made a most fortunate selection, for it secured in him a man whose judgment and powers of organization made him a most able adviser in all its subsequent undertakings. In von Falkenstein's time, Ludwig's influence extended far beyond the sphere of the medical faculty, and some of the most important appointments of that time were due to his suggestion. Later, when at last instruction in the natural sci-

ences had been organized in Leipsic, and the ministry of instruction had passed into other hands, Ludwig again confined himself to his own more limited department. His activity in this field, however, soon spread the fame of the Leipsic University throughout the world.

When Ludwig first came to Leipsic he was in the prime of mature manhood, and had already had twenty years of experience in teaching. He had begun his academic career in Marburg, in 1841, where he had been associated with his friend Ludwig Fick as demonstrator in anatomy. In 1849 he went from there to Zurich as professor of anatomy and physiology, and in 1855 he was called to Vienna to the medical military academy, the so-called Josephinum, as professor of physiology.

In 1852, during his stay in Zurich, Ludwig published the first volume of his text-book of Physiology, the second volume of which appeared four years later, when he was in Vienna. Ludwig's Physiology appeared like a meteor on the scientific horizon. It attacked the scientific knowledge of the day, demolishing former theories and conceptions with critical severity, and substituting new ideas and modes of expression which to us, the physicians of that time, seemed extraordinary enough. I well remember the sensations with which I, as an advanced student, on coming from one of Johann Müller's lectures, toiled through Ludwig's recently published work. Much that it contained I could only master by an effort, and much was actually repugnant to me, for it seemed to me to shatter to atoms the most interesting chapters of physiology as it had existed hitherto. And yet, in spite of all inward opposition, I could not resist the overwhelming influence of this powerful book with its vast stores of information, and I had to acknowledge more and more the force of its triumphant method of presentation.

Wherein lay the great step in advance that Ludwig had taken with his Physiology? Ludwig was a pronounced physical physiologist. A physical physiology had, however, existed long before his time. During the preceding two centuries there had already been schools of mechanical therapeutics in which classical works, as those of Borelli on animal movement, of Hales on blood-pressure, had been produced. Beginning in the second decade of this century, the Weber brothers had proved themselves investigators of the first rank, and their fundamental experiments on wave motion, the pulse, human locomotion, on muscular contraction, etc., were founded on a strictly physical basis. Other men of similar ideas, among them A. Volkmann, subsequently joined them. From the time of Lavoisier, works had been coming from France in which physiological questions were treated in a thoroughly physical method—the treatises of Dulong and Despretz on heat production and dissipation, those of Poiseuille

on the circulation of the blood, and, lastly, the exhaustive work on respiration by Regnault and Reiset. Among Ludwig's personal friends, E. Du Bois-Reymond had between 1840 and 1850 constructed a theory of molecular physics of the nerve and muscle tissue, and Helmholtz, by means of wonderfully ingenious methods, had measured the rate of transmission of the stimulus in living nerves.

The road for physical investigations in physiology was, therefore, already open when Ludwig's book appeared. Moreover, the idea of a vital force, which on account of its obscurity had excited so much opposition, had now become meaningless for scientific investigation, and had besides received its deathblow through Lotze in 1842. What, however, was totally lacking before the appearance of Ludwig's book was a thorough introduction of physical reasoning and methods in physiological instruction. Anatomy was still the ruling branch of science even in physiology, and in some chapters of the latter the physiological problems were actually left out in favor of anatomical or comparative anatomical explanations. This was the more natural, because physiology was still taught by anatomists in most of the universities. Moreover, the regular course of instruction afforded the young physician abundant opportunity of acquiring a thorough anatomical education, while on the other hand a more rigorous training in physics was extremely difficult to obtain. Even to the present day this difficulty has never been satisfactorily overcome.

As anatomical demonstrator and professor, Ludwig himself had been through the dissecting room; he was all his life an excellent anatomist, and thought exceptionally highly of the mission of anatomy. However, in many ways his ideas of this mission differed from those of his predecessors, and even his language was often unlike what had hitherto been in use. He was especially energetic in opposing the idea that the mere description of forms could lead the way to a true understanding of physiology. The controversies between Ludwig and his opponents were vigorously carried on for several years, but at last they grew to understand one another better, and anatomists now have for years been accustomed to respect Ludwig as a valuable fellow-worker and one of the most eminent promoters of their science.

Perhaps nothing is more significant of Ludwig's point of view at the time of his first appearance than the arrangement of matter in his work on physiology. Ludwig's great predecessor, Johann Müller, had prefaced his manual of Physiology with a general chapter on organic matter, on organisms and life, and then proceeded to a description of the great vital functions: the formation and circulation of the blood, respiration, nutrition, etc. Ludwig, on the other

hand, began his presentation with a Physiology of Atoms and of Conditions of Aggregation. As an ideal form of investigation, he conceived the possibility of deducing the functions of complicated molecules from the conditions of their elementary construction, thence, however, to continue step by step to the tissues, and subsequently to the organs. Thus he thought to construct an intelligible theory proceeding from the simple to the complex, and at the same time to determine with mathematical accuracy the derivation of the one from the other in respect to direction, time, and quantity, and to prove the existence of each as the necessary outcome of a natural law.

The theoretical need of an elementary foundation for physiology caused Ludwig in his earlier years to study certain fundamental physical processes, such as filtration, diffusion, and the laws of hydraulics, with especial attention, and to make use of the knowledge thus obtained to explain the phenomena of animal life. Later he grew far more cautious as regards these explanatory experiments, and references to the organic connections of vital processes are much more frequent in his later work. He now speaks with especial predilection of the wonderful mechanism of life, the intricate workings of which, in all its complications, it is the duty of science to reveal.

I here quote a few words from the speech that Ludwig delivered on entering on his professorship at this university: "Physiology," he said, "has entered with full consciousness the sphere of mechanics, where rigorous laws obtain, and where the inexorable logic of circumstances rules the course of the atoms; but we, the heavily burdened servants of science, have armed ourselves with a thousand weapons with which to pursue the intangible phenomena of Nature, and, reflecting on these, we endeavor to understand the subtle mechanism of life. And when we finally receive our reward, when we at last comprehend an organ in all its connections, our proud consciousness is crushed by the knowledge that the human discoverer is but a bungler beside the unknown creator of animal life. For when man compares himself with him in the solution of any problem, he must ever fall short, as does the telescope compared with the eye, and the litmus paper with the tongue. And if all this was once clear, why must it needs again become obscure to us?"

If, however, we desire to understand Ludwig's full importance, we must seek him in his laboratory, and in the midst of his pupils, for here his most characteristic and noblest qualities reached their fullest development. A summary of Ludwig's and his students' work can only be indicated here. With his endeavor to make the construction of the body physiologically comprehensible, Ludwig, unlike some of his friends who were engaged in the same line of work, did not confine himself merely to physical experiments, but

devoted most of his activity to the far more difficult task of experimenting on the living body, a branch of work which in his hands and by his own inventions, the "Kymographion," the "Stromuhr," the mercury pump, etc., gained a precision that up to that time had never been imagined.

His inaugural thesis, that appeared in 1842, at first opposed by the Marburg faculty, treated of the secretion of the kidneys, a subject to the study of which he returned again and again in later years. Another very systematically arranged line of experiments led Ludwig in 1851 to the important discovery of the dependence of the secretion of the saliva upon the irritation of the glandular nerves, and to the recognition of the independence of the pressure of the secretion from that of the blood. This discovery was of fundamental importance for the physiology of secretion no less than for that of the nervous system, and it was at that time all the more surprising, since Ludwig's own suppositions had caused precisely the opposite result to be expected.

Constant objects of intense interest to Ludwig were the peculiarities of the circulating blood, its lateral pressure, and its rate of flow, as well as the dependence of these functions on the activity of the heart, on that of the muscles of the body, on the condition of the vascular muscles, and of numberless other factors. It is in this field that Ludwig's delicate graphic apparatus and his precise methods of measurement won their greatest triumphs. No less are our thanks due to him for a great part of the present knowledge of the mechanism of the heart's activity. It was he who first gave us an idea of the action of the lymph current in the living organism. He determined quantitatively its amount and its variations, and by histological investigations on the origin of the lymphatic system he threw light on the nature of this extraordinary apparatus. Ludwig labored incessantly to obtain a true understanding of respiration, including not only the gas exchange in the lungs, and the respiratory movements, but also the internal or tissue respirations. He was very successful in studying the activity of organs in the so-called state of survival which is produced by conducting a stream of blood through parts taken from a freshly killed animal, and thus the qualities of the blood, the lymph, as well as of various secretions, are determined and compared, both before and after the passage of the blood. When it seemed to him necessary to extend the anatomical foundations of physiological study, he always undertook this himself, or required students to make anatomical investigations. Among many other histological researches, we are indebted to him, above all, for his classic treatise on the structure of the kidneys. The most careful investigations of the blood-vessels of the eye and those of the inner

ear were also made in Ludwig's laboratory. In fact, by the establishment of the histological department of his institute, he exercised a marked influence on the development of minute anatomy.

If Ludwig's experimental methods were characterized from the beginning by their extraordinary precision, this quality was simply the result of the serious cast of his whole character. At whatever time one might happen to enter his laboratory, one always received the impression that it had just been put in order, and that every article was in its proper place.

The numerous investigations which Ludwig caused to be made on the most important parts of the body of course furthered the advance of medical science. The results of his researches benefited theoretical medicine, and his fully developed methods were of great advantage in experimental pathology and in clinical observations. Among Ludwig's pupils were a large number of eminent clinicians. Ludwig himself, however, always attached great importance to his relations to medicine and the practical significance of physiology. "Guiding the course of human life according to the dictates of human wisdom" is what in his great work on physiology he gives as his conception of the true aim of a physician, and later he several times expressed the same idea in somewhat different words.

It would be extremely interesting to follow more closely the influences that caused Ludwig to take up the physical side of physiology. This is now no easy matter to determine, and even inquiries that I have made among his surviving friends and pupils have given me no definite opinion. An accurate manner of thinking and great mental independence were always peculiar to Ludwig, and they were perhaps the qualities that caused him to turn aside from all beaten paths. As a student, this feeling of independence brought him into conflict with the laws of discipline in his university, and resulted in a temporary suspension of his studies there. On his return to Marburg he seems to have finally decided on making physiology his profession, and it was then that he entered Bunsen's laboratory. In the analyses that were undertaken there he probably had his first opportunity of becoming familiar with the more accurate physical methods. There he also had intercourse with other young physicists, among whom was Reiset. Bunsen's strict training must, indeed, have been a strong contrast to the unsystematic routine of the Bamberg surgeon with whom Ludwig had spent his time of suspension. From 1842 (the year of the inaugural thesis) onward he worked on the problems of physical physiology with his friends and pupils.*

* Among the standard works which he recommended to them at that time were the writings of the Weber brothers (*Die Wellenlehre*, 1825; the treatises on the pulse, absorption, auditory and cutaneous sensation, 1834; and the locomotive organs, 1834), Poiseuille's

When, in the course of a few years, the new school of physics in Berlin was formed, he entered on a correspondence with its representatives—with E. Brücke, E. Du Bois-Reymond, and H. Helmholtz. Ludwig's first opportunity of meeting these somewhat younger friends was in 1847, when he made a short visit to Berlin. It was then that he also made the acquaintance of E. H. Weber and A. Volkmann. He seems to have led Volkmann to the use of his recently invented kymographion, for, as is known by common report, they experimented together for a time.

In his manner of investigating, Ludwig was all his life a most acute analyzer, seeking with the utmost care to separate every vital process into its various branches, and to determine the conditions of its manifestations. In this work he always attached great importance to the quantitative determination of all the factors of the problem. This manner of work of course often resulted in the questions that he had investigated seeming further from a satisfactory solution than before he had begun; Ludwig, however, never regarded any line of research as definitely closed, but years later returned again and again to work on the problems he had undertaken to solve, and continued his researches with the help of his added knowledge and experience. Herein lay one of the most interesting sides of his richly endowed nature; in his search for the truth he never faltered, but with untiring energy continually attacked the problem with new weapons.

Ludwig's mode of scientific work was entirely opposite to E. H. Weber's. Weber possessed the gift of artistic intuition. He absorbed himself in his problems until he believed that he had mastered the main substance of the matter, after which he was able in a few clear strokes to draw an illustration of oftentimes wonderful simplicity. Weber's scheme of the circulation, constructed by the insignificant means of a piece of intestine and a few lamp chimneys, solved with one stroke, convincing even to beginners, some of the most abstruse problems of the theory of the circulation, and even the complicated technique of later physiology has not been able to dispense with it. The first one to recognize this was Ludwig himself; in fact, he went so far as to consider Weber's discoveries of greater importance even than Harvey's discovery of the circulation of the blood. Intuitive natures, such as Weber's, may make particularly clear teachers. The artistic perception, however, which is their most valuable quality, can not be transferred to others, and thus we seldom find them as founders of any school of science. Thus Weber, if we do not include his personally congenial friends, never in all his long career attracted scientific pupils. Ludwig, on the other hand, made

a success in this direction with which in this country we can only compare Liebig's successful instruction in Giessen.

The power of attracting young men and interesting them in scientific questions was early noticeable in Ludwig. At Marburg, already in the year 1842, we find him working in connection with his scholars, or, as he always designated them, "his young friends," among whom some, such as C. Eckhard and Ad. Fick, afterward became his physiological colleagues. In the same way, during his six years' stay at Zurich, he gathered about him as fellow-workers in his researches all the stronger elements there. His power of attraction soon spread beyond the limits of the university, and later in Vienna, and finally here in Leipsic increased in a nearly geometrical rate of progression. The number of young men from all over the world whom Ludwig has guided to independent investigation has increased in the course of years to several hundred, and we see on the list some of the first names of our modern scientific world. Yet all Ludwig's pupils have all their lives looked up to him with deepest gratitude and affection, and have recognized how much they profited just from him in the line of intellectual education. "I owe Ludwig," a prominent investigator wrote me recently, "my scientific conscience, and instinctive repugnance to any bungling."

In trying to account for Ludwig's wonderful gift for teaching, I find the first main condition in his highly ideal spirit; the second, however, in his deep love on the one hand for investigating and on the other for aspiring youth. Only he who feels deeply can attach others to himself for any length of time. When Ludwig spoke of his pupils as his young friends this was no mere figure of speech; he was in reality personally interested in them, and even after many years had passed, still followed their later career with all the sympathy of a true friend. When he gave the young men who came to him scientific work to do, and with unselfish devotion taught them the first principles of physiological thought, interrogation, and method, his power of combining the qualities of teacher and fellow-worker was unsurpassed. He knew, moreover, how to deal with each one according to his particular nature, and the large field of work he controlled made it possible for him to give suitable work to pupils of the most varied talents and training. One he placed in the chemical laboratory, another before the microscope; to sensitively organized natures he gave delicate experiments to do, and even if a clumsy worker applied to Ludwig, he was not disappointed, but was placed in the care of that careful and experienced assistant, Salvenmoser. Even if such a pupil was never able to do independent work, he at least had the opportunity of learning by his own observation the great importance of order and precision in all scientific undertakings.

Ludwig's disinterestedness toward his pupils went to such an extreme that he allowed works that had been accomplished under his immediate supervision—generally, in fact, executed by his own hand, and also, as a rule, prepared for editing by him—to go out into the world under the name of the pupil who had assisted him. He not only did this in the latter years of his life, as a world-renowned scientist, but as early as the time of his stay in Marburg, at an age and in a position in which young men are usually less generous with their names. Under the names of Mogk, Spengler, Becher, and others, Ludwig's youthful investigations went forth, and when in 1847 he published his invention, the kymographion, under his own name, he apologized for it, saying that his young friend Gerau, then otherwise engaged, should really have done this. And yet in this case it was the question of one of the most important discoveries in natural history, in view of its later consequences. Ludwig, by means of his kymographion, introduced the principle of self-registering apparatus into science—a principle the importance of which may well be compared with that of the microscope, for it was first by means of such apparatus working as time microscopes that it became possible to directly observe and comprehend rapid and complicated processes.

As with the pupils in his laboratory, Ludwig also associated with his students with friendly sympathy. They all felt this, and returned it with warm attachment and respect. They usually attended each of his lectures two or three times, as the beginners were hardly able to master the information they received at the first hearing. In especial physiological conferences Ludwig gave the students opportunity of talking with him personally. For my part, it was a continual source of astonishment to me to see how accurately Ludwig was informed with regard to the industry and talents of the individual students.

Ludwig's workroom was a place to which the most heterogeneous elements had free access—foreign scientists, colleagues of all the faculties, physicians, friends, and pupils. There one might at any time seek his advice and enjoy the magic of his society. With his many-sided and thorough education, and his ever quickly roused enthusiasm for all sorts of new problems and lines of work, it was easy to interest him in questions of the most varied character. His great knowledge of the world and of human nature made his conversation a never-ending source of interest and information. Ludwig's point of view was ever lofty; the lines of thought on which he worked were always original, never commonplace. With his subtle humor he would occasionally maintain a paradoxical opinion. If, however, he was opposed by arguments that were repugnant to his idealism,

he was also capable of uttering bitter and sarcastic words. His conversation always inspired active thought.

Yet, with all the pleasantness of this social intercourse, his strict self-restraint, the strongest quality of his nature, was always manifest, and this was one of the principal causes of the excellent influence he exercised over young people; they had in him the example of a man who was scrupulously strict with himself, and absolutely conscientious. "Ludwig was also our professor of ethics," one of his American pupils recently remarked to me. And thus Ludwig's life has amply proved that the best and highest that a teacher can give to youth lies in the power of his own personality.

Ludwig's coming and the erection of the Physiological Institute caused a revival of theoretical instruction in our faculty. Two years later the arrival of Thiersch was followed by great changes in clinical instruction. Clinics have only existed in Leipsic since 1798. Up to that time the faculty had professors of pathology and surgery; learned men, who, however, gave no hospital instruction. Even when by the courtesy of the magistrate, and especially through the efforts of the excellent burgomaster Müller, the City Hospital had been opened for clinical instruction, the clinical teachers for a long time had only a subordinate position in the faculty. Only later, in 1812, the professor of clinical medicine (A. Clarus), and in 1824 the demonstrator of surgery (Kuhl) were received into the faculty as full professors.

A report of the faculty of the year 1838, written in Weber's clear handwriting, gives the key to a true understanding of these curious conditions. The Jacob's Hospital, in which the clinic was held, was then, as now, a city institution, the doctor and surgeon of which were appointed by the magistrate, and only later on were confirmed by the government. The first was appointed clinical professor, the latter surgical demonstrator. The financial support from the government was limited to four hundred thalers as a salary for the clinical professor, and one hundred thalers as a salary for the demonstrator of surgery.

The expenses of the hospital fell entirely on the city, the natural result being that the admission of patients was carried on without any reference to instruction.

The above-mentioned report complains bitterly of the existing conditions, and dwells on the fact that the sick-beds were almost entirely taken up by cases of chronic disease, which were practically useless for purposes of instruction. How curious it is now to hear that in 1838 the want of surgical cases was explained by the smallness of Leipsic and the "comparative wealth of the laboring classes"! The surgical demonstrator was subordinate to the clinical professor,

and his duties consisted merely in admitting students twice a week to his visits among the sick, and in winter demonstrating the most important operations on the cadaver. The faculty now in an entirely professional manner desired the government to provide clinical free beds, twenty medical and twenty surgical. To this request was added a list of suggestions for the organization of a course of instruction in clinical surgery, for the furnishing of a collection of instruments, and for a practical operative course.

The adoption of these recommendations of the faculty was the first decisive step toward a more perfect organization of surgical instruction; a second step was taken in 1841 through the appointment of Professor Günther, of Kiel, as professor of surgery and surgical demonstrator. Thus the existence of a regular surgical clinic in Leipsic dates back hardly fifty years. Even then the conditions of its existence were unfavorable enough, and hospital gangrene, in spite of the open-air barracks devised by Günther in the surgical department of the hospital, was a matter of inevitable recurrence. The surgical clinic only attained its full development a generation later, under Thiersch. It was also he who put an end to the unworthy subordination of the surgeons to the physicians.

Günther died in 1866, and after his death it is again a report from the pen of E. H. Weber which sets forth the point of view of the faculty. The first necessity seems to be now to provide a more suitably arranged hospital; the faculty therefore insists on the importance of appointing a man able to undertake the task of organizing its erection. This requirement was entirely fulfilled by the appointment of Thiersch in the following year, 1867.

At the time when the task of attending to the building of the new Jacob's Hospital with Wunderlich fell to Thiersch, the allied questions of surgical treatment and of hospital construction were undergoing a thorough revolution. As early as between 1850 and 1860 French physicians had recognized the mortifying fact that in English hospitals the number of successful operations was incalculably larger than in their own. The most careful examination of the conditions of both resulted only in the discovery of the far greater cleanliness and better ventilation of English institutions. Moreover, an English physician, Spencer Wells, had applied the principle of absolute cleanliness to operations in the abdominal cavity with startling success, thus making these previously almost necessarily fatal operations comparatively harmless. During the American civil war, important knowledge as to the best conditions for the treatment of wounds was gained. It was discovered that the wounded recovered most safely and rapidly in the airiest apartments, in lightly built barracks, or in open tents. Thiersch, with his keen insight, at once

recognized the advantages of the American system, and he was the first in Europe to have a large hospital built on the plan of barracks. In the Jacob's Hospital, which was built according to his directions, there are a great number of long-shaped buildings in a park, so distributed that the two long sides of each are free, and having at one end an airy veranda, into which beds may be pushed at any time. Air and light, these two "unpaid but invaluable assistant physicians," as Thiersch said, have free access to every patient. The system proved so excellent that in the course of years more and more barracks have been added, and the Jacob's Hospital has long been regarded far and wide as a model of such an institution. When, soon after the opening of the hospital in 1871, Lister's beneficent methods of surgical treatment were made public, it was again Thiersch who at once recognized their enormous significance, and advocated them with all his power. This beautiful hospital offered him the best possible conditions for the carrying out and further development of the newly acquired methods, as well as for their introduction in the education of the younger medical generation. There he worked during the past twenty-four years, not only as a teacher revered by all, but also as a faithful physician; and he so loved his hospital that even during his time of suffering he occupied himself ceaselessly with it, and one of the last wishes he expressed was that he might be able to return there once more.

Carl Thiersch, when he came to Leipsic, had occupied the chair of surgery in Erlangen since 1854, before which he had for six years been prosector in the Pathological-Anatomical Institute in Munich. He seems to have acquired his tendency toward surgery in 1850, during the second Schleswig-Holstein War, in which he served as volunteer physician under Stromeyer.

It is much more difficult to appreciate Thiersch's works in their connection than Ludwig's. In the case of the latter, when as a young man he came before the public, we have to do with an intellectual force of great intensity, and of a scientifically well-defined tendency. His whole life was given to the accomplishment of certain objects which he had placed before himself in the beginning of his career, and in following the course that was to lead him to his aim, he persistently sought, in all his work, to attract intelligent young men to his scientific researches.

Thiersch's development was of a different nature, and in order to understand what he accomplished it is necessary first of all to study his personality. Descended from a well-known scientific family, Thiersch brought with him the taste for thorough knowledge and for delicate intellectual understanding. He possessed the strict desire for truth and the independent disposition of the true scientist.

He loved, moreover, to absorb himself in especial problems, even when they really did not belong to his department. His address as rector at Erlangen on teaching and studying, and especially his Hamlet Glossary, show how much he also liked to devote himself to problems of human psychology. With all this tendency toward the subtleties of mental analysis, Thiersch was yet an accurate observer, and full of sound common sense. Endowed with such qualities, he easily developed into a clever and experienced judge of human nature. His fine command of language made him a spirited and much-admired speaker. As a general thing, however, he made sparing and thus most effective use of this gift, and even in expressing serious thoughts he often employed the weapon of a never-failing humor.

Thus Thiersch was one of those harmoniously gifted and well-rounded natures who have the power of accomplishing well any task that presents itself to them. As scholar, investigator, and physician, in the service of peace or of war, as well as now and then in executive positions, he always filled his place and accomplished excellent work. He never put himself forward, but rather let people and things come to him; yet nothing was further removed from him than ostentation, whether as regards his erudition or any other of his mental endowments. He preferred to hide his fine qualities beneath a mantle of dry humor. Those who did not see this absolutely conscientious man at work might well be doubtful as to his real earnestness. He was, however, extremely sensitive to vanity and obtrusiveness in others. When he met with these qualities, he could repel their owners severely by dignified reserve or by pointed remarks. The students who were aware of this danger perhaps avoided it with unnecessary care.

Thiersch's scientific works, whether on theoretic or practical questions, produce an impression of great maturity and perfection. Often original in their conception, they are always very careful in their plan and execution, and clear in the form of their presentation. His first printed essay, a medical dissertation on *materia medica*, still shows Schelling's youthful pupil. In the language of natural philosophy, he tries in it to deduce the action of medicaments from principles of the most abstract kind. But Thiersch did not remain long in this field. In his next works, which he undertakes as prosector, he proves himself already a creditable and thoughtful naturalist. It is the same in his investigations on *pyæmia*, on the formation of the sexual organs, and in his great experimental treatise on the origin of cholera. When Thiersch became a surgeon, his thorough theoretic knowledge was again and again of use to him, and he also was able to employ to great advantage his re-

markable skill in injecting fine blood-vessels. His most celebrated work is the monograph on epithelial cancer, in which he first determined with precision the origin of malignant tumors, and at the same time drew the most important practical conclusions from an essentially embryological idea. His excellent treatises on the healing of wounds and on transplantation of the skin are no less based on theoretical preliminary study. The certainty of his surgical methods was with Thiersch the result of his anatomical and pathological knowledge. In a thoughtful obituary notice, Professor Landerer, one of his former pupils, writes: "Thiersch's operating was the direct outcome of applied and pathological anatomy. With his phenomenal knowledge of these departments he could allow himself to build up his plan of operation directly on the diagnosis, and always to proceed as a free, creative worker."

Thiersch is reported to have said of himself that he was really an anatomist gone astray. In the interest of suffering humanity, however, it was surely well that he turned from anatomy to surgery, for he was a surgeon by the grace of God. He possessed not only the necessary firmness of eye and hand, but also a sovereign calmness that even in the most trying situations never failed him. Above all, the most beautiful quality that a great physician can have was his: he was possessed of delicate sensibilities, and was thoroughly humane in his disposition. This last quality was perhaps the most prominent of Thiersch's many virtues, yet it was the one he endeavored most carefully to conceal. He burdened his heart with every one of his seriously sick patients; in critical cases he hurried to the hospital at the most unusual times, and if, contrary to his expectations, a serious operation resulted unsuccessfully, it was often days, and even weeks, as Landerer tells us, before he could reconcile himself to the result. He would criticise himself severely in order to determine whether he had not some mistake or neglect with which to reproach himself.

Thiersch's favorite resort was the children's wards. There he could devote himself to each without reserve. He remembered each of his little patients, and when, after their leaving the hospital, he occasionally met them in the street, he used to speak with them and inquire after their health. And for this the "Herr Geheimrath" was deeply revered by all who had been his patients, and it was a festival for them when his birthday or some other occasion gave them an opportunity of showing their affection by some little attention.

I should overstep the limits of an academic discourse if I followed further the tender side of Thiersch's personality. Yet one thing I must not pass over: that is, the beneficent influence of his humanity

upon his pupils. It is only too easy for young physicians to become callous to human suffering, which they are daily called upon to witness, and unless carefully guided by a teacher their manner toward patients may easily become inconsiderate. Like his deceased colleague, Wagner, Thiersch was one of those teachers whose benevolent dispositions exercised an ennobling influence over their pupils, and at once checked any tendency toward coarseness in word or thought.

The striking power of Thiersch's personality was at once felt by any one with whom he came in contact. His decisive bearing, his clear and sure judgment gained great respect for him in all circles. Among his surgical colleagues and at our academic meetings his opinion was depended on as a decisive one in all difficult questions.

As companions in the faculty, Ludwig and Thiersch supplemented one another admirably. Each one fully appreciated the other's value. Ludwig's aims were always of an ideal nature and always high. In the struggle to reach them he knew no compromise. It often seemed to me as if Ludwig, in his somewhat austere severity, was the embodied conscience of the faculty. Thiersch, on the other hand, with his intelligent insight, always knew where to find the starting point from which the object to be sought for was accessible. Both men were equal, however, in their sincerity and in the independence of their dispositions, both absolutely free from private considerations, and only anxious for the well-being of the institutions intrusted to them.

The names of Carl Ludwig and Carl Thiersch will be revered by our university for many years to come. Long will she be proud to have possessed two such large-minded and noble men. Such a possession is lasting in its consequences, for it will have an elevating and strengthening influence on coming generations. The memory of both men will always be blessed.

WHILE fully recognizing the influence of the inheritance of the imagination of his grandfather and the acute observation of his father on the formation of Darwin's scientific habits, Mr. A. R. Wallace mentions as other factors which have been usually overlooked the five years' voyage and his persistent ill health. During a very large portion of the five years on the *Beagle*, Darwin must have been practically alone and thrown on his own mental resources; and this mental solitude of an active mind, furnished continually with new and interesting facts on which to exercise the imaginative and reasoning powers, led to the formation of those original and suggestive ideas which were the foundation of his greatness. Hardly less important was the almost continuous ill health, which, while not preventing work or shortening life, obliged him to live in the country, free from the distractions of society, where his active mind could only be satisfied by continual study and experiment.

PRINCIPLES OF TAXATION.

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XIV.—DOUBLE TAXATION.

ONE of the inevitable characteristics of a "general property tax" is the opportunity afforded for inflicting double taxation—i. e., taxation at one and the same time on the same person or property, or taxation of the same property a second time in the same year—an opportunity which the believers in this system vigorously defend, and its administrators as a rule gladly take advantage of to practically enforce. These opportunities exist mainly through two assumptions, neither of which are warranted by either reason or justice, and are alike antagonistic to any equitable and intelligent system of taxation: the *first*, in respect to the *situs* of personal property, and the *second*, as to origin and nature of property; and to these, in the above order, attention is next invited.

Personal property for purposes of taxation is *popularly* divided into two classes—namely, things movable, tangible, and visible, and things wanting in corporality or bodily presence, and therefore, as a rule, intangible and invisible. To the former has been given the general name of "chattels," and to the latter that of "credits"; under which latter name or title are included not only book accounts, bills payable, promissory notes, bonds, mortgages, deeds, bank deposits, certificates of indebtedness, and the like, but also shares of corporate stock, and possibly shares in any partnership. Adopting a popular theory, that credits are property, their aggregate value in all civilized countries can not, probably, be reasonably estimated at less than one half of the aggregate value of all chattels and real estate.

SITUS OF PERSONAL PROPERTY.—As has been already pointed out, it is in the nature of an economic axiom and a fundamental legal principle that the power of every state to tax must be exclusively limited to subjects within its territory and legal jurisdiction. This economic axiom and legal principle is recognized in nearly all countries claiming to be civilized; the principal exceptions being in the States of the Federal Union, where it is violated in respect to both theory and practice—more especially in the State of Massachusetts, the statutes of which define personal estate for purposes of taxation so as to include "goods, chattels, money, and effects, wherever they are; ships, public stocks and securities, stocks in turnpikes, bridges, and moneyed corporations, *within or without the State.*" Thus, for

example, if a resident of Massachusetts owns a cow which is bodily in another State, that cow is properly taxed in the State where the animal is; but Massachusetts, in virtue of the residence of the owner within her territory, imposes upon him a second tax for the same cow. Again, owners of shares in corporations chartered and located in Massachusetts are taxed through the corporation, and their shares are free from any further taxation. But if the same persons are shareholders in corporations created and established by other States, and the real and personal property of which are fully taxed where situated, they are subject to a second tax in Massachusetts on the assumed local value of the interest of their citizens in such extra-territorial corporations.

Under this system, moreover, the same property may be, and often actually is, subjected to not merely double but triple taxation, which sometimes practically amounts to confiscation. Thus personal property belonging to a citizen of Massachusetts, but located in Chicago, would be properly taxable there, because within the territory and under the protection of the taxing power. It would, however, be taxable to the owner in Massachusetts because of his personal residence in that State; and the owner would also be liable to taxation in Massachusetts by reason of his income from the same property. The following case of actual and comparatively recent experience constitutes both proof and illustration of the accuracy of this statement: A lady of a Western State, for the sake of availing herself of certain educational advantages, removed to a town in Massachusetts near Boston, and benefited the town by building a fine residence therein. Her property, which was held by a trustee in Indiana, was taxed to him by reason of his legal holding in that State. The property itself, mainly in another State, was taxed there, and properly, by reason of its location; but at the end of her first year's residence the lady was horrified to learn that a third tax on her income was demanded of her by the tax laws of Massachusetts. "And this," the person communicating these facts adds, "will, if enforced, be a decree of my personal banishment from the State as effectual as that which the State formerly launched against Roger Williams and the Quakers." Can any one doubt that human nature, as ordinarily constituted, will protest against, and successfully evade such laws? Would it not be well in discussing this subject to mention also that it was a question of taxation that gave liberty to the American colonies, and that the principle that the people of Boston and their ministers once mainly relied upon to justify their destruction of imported tea, which they regarded as unjustly taxed by even a small amount, was "that resistance to tyranny was obedience to God"?

The claim or argument, however, which the advocates of such

an unjust system now set up in its defense is not a theological one, but that personal property (more especially what is termed in law *choses in action*, or credits, titles, notes, bonds, mortgages, which are in their nature incorporeal, and therefore invisible and intangible) has no *situs* away from the person or residence of the owner, but is deemed to be present with him at the place of his domicile.*

This rule or fiction of law originated, according to Savigny, in Rome, and acquired the designation of "*mobilia personam sequuntur*"; but its applicability to property was never held to extend beyond Roman territory. Subsequently it became a device of international comity, which the Supreme Court of Vermont (*Catlin vs. Hall*, 12 Vermont, 152) has declared was subsequently "adopted from considerations of general convenience and policy, and for the benefit of commerce"; and which, according to every principle of common sense and equity, was never invented with a view of its being used as a rule to govern and define the application and scope of taxation, or was intended to have any other meaning than that for the purpose of the sale, distribution, and other disposition of property any act, agreement, or authority which is sufficient in law where the owner resides shall pass the property in the place where the property is; and more especially to facilitate the distribution of decedents' estates, by enabling parties to dispose of their property without embarrassment from their ignorance of the laws of the country where it is situated.†

How comparatively recent, moreover, has been the extra-territorial application of the rule or principle under consideration to taxation, is shown by the fact that the first English colonists and law-makers who came to America do not appear to have brought with them any of the narrow and illogical views which have characterized their descendants. Thus, for example, one of the earliest laws of the Massachusetts colony reads as follows: "*No man shall be rated here (Massachusetts) for any estate or revenue he hath in England, or in any forreine partes, till it be transported thither.*" (Massachusetts Historical Society Collections, vols. vii and viii, page 213.) And in the first provincial codes of Pennsylvania especial care was taken to confine taxation to land, and a very few articles of personal prop-

* This subject, from its modern and strictly legal aspect, will be discussed hereafter.

† "No fiction," says Blackstone, "shall extend to work an injury; its proper operation being to prevent a mischief, or remedy an inconvenience, which might result from the general rule of law." At any attempt to misapply a fiction, it falls within, and is terminated by, that other authoritative maxim of logic and the common law, *cessante ratione legis, cessat ipsa lex*. Another great authority in law, Lord Mansfield, says: "Fictions of law hold only in respect of the ends and purposes for which they were invented; when they are urged to an intent and purpose not within the reason and policy of the fiction, the other party may show the truth."

erty of a visible character, as slaves, horses, and cattle, and to exempt from taxation debts, accounts, merchandise,* and all other items susceptible of concealment, and which would necessitate inquisitorial methods for assessment. And it was not until 1847, when the State had become financially embarrassed by large expenditures, that any change was made in such system. But in later days, when laws came to be made by legislators who could not conceive that anything more was involved in taxation than the raising of a given amount of money, the discriminating rule in respect to the *situs* of real and personal property was generally adopted and has resulted in the before-mentioned absurdities. Another involved absurdity is that those States which adopt in their systems of taxation the rule of

* In a report of the law committee of the Common Council of the city of Philadelphia, submitted February 16, 1871, we find the following historical review of the tax laws of Philadelphia, under the government of William Penn and his successors in the colonial government:

"These laws were framed to avoid repeating errors (in respect to the taxation of personal property) which had been proved by long experience in Great Britain and the Continental countries to be inquisitorial in their nature, and by concealment, evasion, and perjury demoralizing to the people. We find the Provincial Council (1683) first determining that 'a publick tax on land ought to be raised to defray the publick charge,' and the enactment of 1700, fixing county rates and levies (which law was not enrolled), is believed to have been not larger in the subjects of county rates than in the act of 1724, which were real estate, horses, cattle, sheep, negroes, and a poll tax. It will be noticed that the personal estate here enumerated was visible property not susceptible of concealment, and that debts, accounts, merchandise, and ships are nowhere mentioned. In the several enactments that followed in 1795, 1799, and 1834, the subjects of county levy were substantially the same, sheep and slaves being omitted in the last act, and officers added to the last two, and it was not until 1844, a period when the State, by large expenditures, had become embarrassed, that, by the act of 29th day of April, 1844, mortgages, money owing by solvent debtors, stocks, household furniture, public loans, watches, etc., were made taxable for county purposes. The attempted enforcement of this act was so injurious to the people, by driving capital and industrial establishments from the State, and so evaded in returns, that by common consent the law remained on the statute book a dead letter until the consolidation of the city.

"At that time (1854) the question was again discussed, and although the councils of the city had the power to impose the tax rate upon all the subjects of taxation, in the thirty-second section of the act of 1844 we find, by the first ordinances, they limited the levy to real estate, furniture, horses, cattle, and pleasure carriages, and so continued until 1864, when an act was passed empowering the city to levy taxes on all the subjects of taxation contained in that section of the act of 1844, a power which they possessed before, but had not exercised.

"Since that time the authority of the city to levy a tax on mortgages, stocks of Pennsylvania corporations, and occupations, has been repealed. In considering the enlargement of the subjects of levy in this city, the fact must not be lost sight of that the State does not impose any tax on real estate for State purposes, but derives all its revenue from corporation stocks and loans, mercantile license, tavern licenses, collateral inheritance, etc., and it is estimated that of the gross receipts for 1870 (\$6,336,603) more than two fifths of the amount (\$2,600,000) was derived from the property and business interests of the citizens of this city."

taxing property beyond their sovereignty or territorial jurisdiction, by reason of the possession of its owner, do not follow to a logical conclusion the principle they have adopted; for they do not hold that real estate, as well as personal property, follows the domicile of its owner for taxation. But for this distinction no good reasons can be given, although pretexts, claiming to be reasons, may. One claim, however, is obviously as good as another. A robber who should draw romantic distinctions between watches and purses would fail in business. If we are to be robbers in practice, let us, at least, secure some grace by honesty in our professions, and admit that what we thus take is not a tax received as the just recompense of a benefit conferred, *but a compulsory levy, having its cause in our greed and its justification in our power*; and as these reasons are as good for a large levy as a small one, and the whole of a man's estate is greater than its part, why not take the whole? Still further, if it is right to tax a man in Massachusetts, who has come for a lengthened stay from another State or a foreign country, for the property he has left behind, why not the man who has come for a week? If we are to do business upon the principle that "might makes right," would it not be a brilliant stroke to station ourselves at all the avenues of ingress to a State, and cry "Stand and deliver!" to the passengers? From the above citations and arguments, the conclusion would seem to be inevitable that when a State assesses property situated beyond its territory and jurisdiction, and which its laws and processes are not competent or able to either reach or protect, or assesses one of its own citizens in respect to such property, the act has no claim to be regarded as taxation, but is simply *arbitrary taking*, in no respect different in principle from confiscation.

It will also be interesting here to recall some of the antecedents of this fiction of law, that personal property, irrespective of its *situs*, follows the owner for the purpose of taxation. Its prototype was the ancient *taille*, or tax of servitude, imposed on persons originally bondmen, or on all persons who held *in farm*, or *lease*, or resided on lands of the suzerain, and from which proprietors or suzerains of the land were exempt. And as no vassal could at will divest himself of servitude or allegiance to his lord or suzerain, so the obligation to pay taxes always remained upon him as a personal servitude, whatever might be the location of his property. In other words, the condition of the masses all over Europe during the middle ages was not unlike the condition of the slaves in the United States previous to emancipation. They (the slaves) had property in their possession, and spoke of themselves as owners of property, but in reality their property followed the condition of the servitude of their persons, and both persons and property belonged equally to

the masters. The *taille*, furthermore, as a badge of servitude, was supposed to dishonor whoever was subject to it, and degrade him, not only below the rank of a gentleman, but that of a burgher, or inhabitant of a borough or town; and "no gentleman, or even any burgher," says Adam Smith, "who has stock, will submit to this degradation." Now, the idea embodied in the word servitude is an obligation to render service, irrespective of or without compensation; and the idea upon which the taxation of personal property in this country has been based is, that the property owes a servitude to the State where the owner resides, irrespective of its actual location, in virtue of the obligation which its owner, as a citizen, may owe to the State by reason of the protection which the State gives him in respect to his person.

Again, in old times, the division of property into real and personal was wholly unknown; and under the common law all property was classed as lands, tenements, hereditaments, and goods and chattels. "In the course of time, however, leases of land for a term of years were classed as chattels, and were distinguished as *chattels real*; while other chattels, which did not savor of lands, were called *chattels personal*, 'because,' says Lord Coke, 'for the most part they belong to the person of a man, or else for that, they are to be recovered by personal actions.' And Blackstone tells us that 'chattels personal are property, and, strictly speaking, things movable, which may be annexed to, or attendant on, the person of the owner, and carried about with him from one part of the world to another'; and as instances he mentions money, jewelry, garments. Personal property, in fact, consisted almost entirely of such things as could be, and actually were, carried about with the person of the owner, or could be easily secreted. And Blackstone also tells us that the amount of the personal estate of our ancestors was so trifling that they entertained a very low and contemptuous opinion of it; and that our 'ancient law books do not, therefore, often condescend to regulate this species of property.' Nothing of an incorporeal nature, as credits, bonds, and mortgages, certificates of stock, was anciently comprehended within the class of personal chattels, and in fact there were few or no such instrumentalities for representing or facilitating the exchanges of property. It was otherwise as to lands or real property, as to which 'incorporeal hereditaments' occupied a conspicuous place from the earliest times. Such was personal property in the early history of our laws. It was of comparatively small importance, and its laws were few and simple; while real property, being of a fixed and permanent nature, was regarded as immeasurably more valuable, and was governed by laws of its own, of the most intricate and abstruse character. And because of

the feudal tenure by which lands were held arose the notion, which became a fiction of the law, that property, merely personal, always attended the person of its owner; while lands, tenements, and hereditaments, being fixed and immovable, and of infinitely more consideration, were held, from their very nature, as well as from motives of political policy, to have a *situs* of their own, from which they derived their laws and incidents, wholly regardless of the domicile of the owner. Growing out of the same reasons, it was also the prevailing opinion that, while immovables were exclusively governed by the law of locality, movables were controlled, according to the same maxim, by the law of the domicile of the owner, and not by that of its *situs*." In the changed condition of wealth and property, such a fiction, however suitable and useful in primitive times, would now, in many cases, work the greatest injustice, and impair the supremacy which every government should maintain over everything within its territory, both on the ground of public expediency and the private interests of its citizens. And, according to Wharton (Treatise on the Conflict of Laws, 1872), this fiction of law has been universally abandoned upon the continent of Europe, except in cases as to rights in respect to personalty which sprang from marriage and succession, and would not, furthermore, in Europe, find a place in any discussion of the principles of taxation, except possibly in a review of curious tax experiences, and for the reason that nowhere, except in the United States, is there any system of extra-territorial taxation, or any tolerance given to the ideas upon which it is founded.

This question of extra-territorial taxation has been raised repeatedly before the highest courts of the United States, and its *illegality* in respect to *visible, tangible property* is believed to have been in every instance affirmed.

Thus in the State of New York, up to the years 1861-'62, the rule of assessment of personal property appears to have been in accordance with that now recognized in Massachusetts—viz., that it follows the owner under all circumstances; but in that year a case of much importance was carried up to its Court of Appeals under the following circumstances: One Hoyt was taxed in the city of New York for personal property, and resisted the taxation on the ground that, although he had personal property outside of the State, he had none within the State in excess of his just debts and liabilities; the property in question without the State being capital employed in business in New Orleans, and farm stock and household furniture in New Jersey, each taxable by local law in the States where situated. The Court of Appeals decided the assessment to be illegal, and held (Comstock, C. J.) that the property was actually

situated in other States, in other sovereignties, protected by their laws and taxable there, and therefore it ought not to be subject to a second taxation in New York.

The court also, in rendering the decision, used the following language: "There seems to be no place for the fiction" (that personal property follows the owner) "in a well-adjusted system of taxation. In such a system a fundamental requisite is that it be harmonious, but harmony does not exist unless the taxing power is exerted with reference exclusively either to the *situs* of the property or to the residence of the owner. Both rules can not obtain, unless we impute inconsistency to the law and oppression to the taxing power. Whichever of these rules we find to be the true one, whichever we find to be founded in justice and the reason of the thing, it necessarily excludes the other; because we ought to suppose, indeed, we are bound to assume, that other States and governments have adopted the same rule. If, then, proceeding on the true principles of taxation, we subject to its burdens all goods and chattels actually within our jurisdiction without regard to the owner's domicile, it must be understood that the same rule prevails everywhere. If we proceed in the opposite rule, and impose the tax on account of the domicile, without regard to the actual *situs*, while the same property is taxed in another sovereignty by reason of its *situs* there, we necessarily subject the citizen to a double taxation, and for this no sound reason can be given."

In further support of its position the court made use of the following illustration: "A citizen, a resident of Massachusetts, may own a farm in one of the counties of this State, and large wealth belonging to him may be invested in cattle, in sheep or horses, which graze the fields, or are visible to the eyes of the taxing power. Now, these goods and chattels have an actual *situs* as distinctly as the farm itself. Putting the inquiry, therefore, with reference to both, 'Are they real estate, and personal?' so as to be subject to taxation under that definition. It seems that but one answer can be given to this question, and that answer must be according to the actual truth of the case. If we take the fiction instead of the truth, then the *situs* of these chattels is in Massachusetts, and they are not within this State. The statute means one thing or the other; it can not have double or inconsistent interpretations; and as this is impossible, so we can not, under and according to the statute, tax the citizen of Massachusetts with respect to his chattels here, and at the same time tax the citizen of New York in respect to his chattels having an actual *situs* there. *In both cases the property must be within the State, or there is no right to tax at all.*"

Since this decision by its highest court, personal property, though

owned in the State of New York, is not taxable to its owner there, provided it is capable of and has a permanent *situs* away from the owner or his domicile.

The United States Supreme Court (*Hayes vs. Pacific Mail Company*, 17 Howard, 713) decided that the *situs* of a vessel for State taxation is only at the port where it is registered, and not where it may happen to be.

In the case of *The City of New Albany vs. Meekin* (3 Indiana Reports, 481), the defendant was a resident of New Albany, and was assessed for personal property in respect to a steamboat enrolled at Louisville, Kentucky, and which touched only occasionally at New Albany. It was held that the tax was illegal, the Supreme Court observing that "the only question we have to consider is whether the boat or the defendant's share is within the city."

It is also an interesting circumstance that this legal controversy concerning the *situs* of a ship for the purpose of taxation has its almost the exact counterpart in the records of English law; case after case having formerly come up before the English courts in which the question involved was: Shall the ship or her owners be taxed at the place of the vessel's registry, or at the domicile of her proprietors? The ultimate decision was, that the only *situs* of a vessel for taxation is the port of her registry, and this decision was recognized in practice until Parliament and the people arrived at the conclusion that it was for the interest of the nation that ships should no longer be taxed directly in any manner.

The United States Supreme Court, in the case of the Northern Central Railroad *vs. Jackson* (7 Wallace 262), also affirmed the principle that two States *can not tax at the same time the same property, nor can a State tax property and interest lying beyond her jurisdiction*. The railroad corporation in question, extending from Baltimore in Maryland to Sunbury in Pennsylvania, was the result of the consolidation of four railroad companies, one incorporated by the State of Maryland and three by the State of Pennsylvania. The latter State imposed a tax of three mills per dollar of the principal of each bond issued by said road, which tax the company, at their office in Baltimore, deducted from the coupons of the bonds of said consolidated road held by Jackson, an alien, resident in Ireland. The court, by Mr. Justice Nelson, decided adversely to the tax, on the ground that the bonds were issued upon the credit of the line of the road, a portion of which was within the jurisdiction of the State of Maryland, and that the security, bound and pledged for the payment of the bonds and of the interest on them, embraces the Maryland portion of the road equally with that portion situated in the

State of Pennsylvania; respecting which condition of affairs the court used the following language:

"It is apparent, if the State of Pennsylvania is at liberty to tax these bonds, that to the extent of this Maryland portion of the road she is taxing property and interest beyond her jurisdiction. Again, if Pennsylvania can tax these bonds, upon the same principle Maryland can tax them. This is too apparent to require argument. The consequence, if permitted, would be double taxation of the bondholder, and its effect is readily seen. Thus a tax of three mills per dollar of the principal, at an interest of six per centum, payable semiannually, is ten per centum per annum of the interest; a tax, therefore, by each State, at this rate, amounts to an annual reduction from the coupons of twenty per centum; and if this consolidation of the line of the road had extended into New York or Ohio, or into both, the deduction would have been thirty or forty. *If Pennsylvania must tax bonds of this description, she must confine it to bonds issued exclusively by her own corporations.* Our conclusion is, that to permit the deduction of the tax from the coupons in question would be giving effect to the acts of the Pennsylvania Legislature upon *property and interests lying beyond her jurisdiction.*"

Again, the national (United States) bank act acknowledges, and the courts of the United States have so held, that a bank has a *situs* and its shares a *situs* where the bank is located, and not where the stockholders reside. The national bank act, therefore, discards the usual State principle of taxation, that personal property follows the owner.

A debt incurred for stock in a corporation has recently (1897) been held by the Appellate Supreme Court of New York as non-taxable, because the assets represented by the stocks are assessed and taxed.

But are credits, in any or all of the various forms in which they are exemplified, property? This question brings us face to face with another of those curious anomalies of opinion and practice that characterize this whole subject of taxation.

In most of the States of the Federal Union credits are generally regarded as property, and are made the subject of taxation at the residence or domicile of their owner, and are held to embrace all debts due from solvent debtors, whether on account, contract, note, bond, or mortgage, and stocks in moneyed corporations, irrespective of the place where such securities may be at the time the assessment shall be made. In States, however, like New York, which reject the assumption that the *situs* of *movable, visible*, personal property for taxation follows the owner irrespective of its actual location, and accept the decision of its own courts, that the *situs* of such property

for taxation is *where it is*, and independent of the domicile of its owner, the opposite rule is held to apply to credits.

On the other hand, in all other countries of high civilization, credits are not regarded as property in the sense of an actuality, and are not subjected to direct taxation. In France, which is at the present encumbered with a greater national debt than has ever before been borne by any nation, and where almost every expedient for raising revenue to defray its extraordinary national expenditures has been resorted to, no attempt or even a proposition has been made to tax credits. It is, therefore, of the first importance that the American public, and especially that portion of it that enacts tax laws, shall have a clearer and more correct idea of the nature of property than it now possesses; and that there shall be eliminated from all such laws the idea that extensively prevails in the United States, but in no other country, that "nothing" can be "something," if a statute will only so provide.

That there is some warrant and defense for such an idea is to be found in the fact that there is not a unity of opinion among economists on this subject; and that in common parlance and dictionary use the term "property" is made applicable to the qualities, rights, and titles of "things" equally with the things themselves. Thus, according to the ancient though still existing law of Scotland, what is termed "real property" in England is termed "heritable rights" in Scotland, and what is termed "personal property" in England is termed "movable rights" in Scotland. Ancient usage is, however, no warrant for the continued use of definitions not applicable to new conditions, and the acceptance of which as authority for conduct is provocative of immorality, injustice, and unsound fiscal policy. Prof. H. Dunning Macleod, a distinguished English economist, who has many adherents, has vigorously advanced the idea that everything that can be bought and sold is property, and assigns to the old Greek philosopher Aristotle the honor of its original conception; but without mentioning that at the period at which Aristotle lived there was practically nothing bought or sold except things tangible and visible, and that credits were practically unknown.

Attractive as this idea may be in theory, it needs but practical application to demonstrate its absurdity. Thus, when the Church sold "absolution" from sin, did the buyer, to quote from old Wycliffe, "have property in ghostly goods, in which no material or property may be regarded as inhering"? Service, again, is bought and sold; but when its purchase, as in the case of the hire of incompetent or dishonest persons, results in the impairment or complete waste or destruction of property, is it entitled to be regarded as property? When a ticket to a theater or concert is sold and bought, can the temporary

right to a seat, or the brief sense of pleasure which the purchaser receives in return, and which he can not perpetuate without renewed buying, and can not transfer to another person, be entitled to be called property? "When socialists and communists," says Professor Macleod, "wish to destroy property, it is not the material things they wish to destroy, but the exclusive right which private persons have in them." If this assertion is warranted, the question is pertinent, Why is it, when socialists or communists have the opportunity to destroy property, they rarely proceed against property over which private persons have exclusive control—like private dwellings—but rather against monuments or buildings, and constructions which are acknowledged to be public as respects use and control? Again, Professor Macleod further holds that not only is the right to a thing, which is not at the time of sale in existence, but is to be acquired in the future, property; but also that a *mere promise* to deliver a commodity is property of the same general nature as money and an actuality.

THE FOREIGN-HELD BOND CASE: A NEW CHAPTER OF PROGRESS.—Any review of this general subject of "double taxation" would be imperfect that failed to particularly call attention to a decision of the United States Supreme Court which, although of the first importance as touching the correct administration of a free and intelligent government, has thus far attracted little attention, even among members of the American bar.

The subject in question, furthermore, illustrates the historical principle that changes in free governments have more often been effected through the decisions of their highest courts than by direct legislation. Thus it is known to all who have examined the theory and practice of local taxation in the United States, that a hundred years ago or less, the lawmakers of England entertained very generally the same opinion in regard to this subject which is yet popularly accepted in this country, namely, that in order to secure exact justice and equality it is essential to attempt to subject all property of the taxpayer—real and personal, tangible and intangible, visible and invisible—to one uniform rate of valuation and assessment; although it must then, as now, have been evident to every one on reflection that, in order to attempt to do this, it would be necessary to endow the assessors with more than mortal powers of perception, so as to enable them to see what was invisible, and measure what was intangible and incorporeal (debts and credits, for example); and that, in default thereof, any practical application of this theory must result in rank absurdity and injustice. And yet it is curious to note that the change in English taxation, when it came about, was not due to any such process of reasoning on the part of the people, or to

any positive sentiment on the part of the state, but rather to a series of legal decisions by its courts, which gradually undermined the whole system of British local tax assessment, until it tumbled down, as it were, imperceptibly, and gradually became replaced, from necessity, by a theory which approximated more closely to the principles of sound political economy and the dictates of common sense.

Thus, one of the first of the old-time maxims which gave way under these decisions was the fiction of law that all property for the purpose of taxation followed the person or domicile of the owner (in virtue of which real estate was once taxed, under the British system, where the owner resided, in place of where the property was situated, used, and protected), and its replacement by the more rational principle that for all purposes of assessment the *situs* of property is where the property actually is; while other decisions of a similar character, following one another by intervals of years, forbade the taxation, for local purposes, of all evidences of national indebtedness, or "consols"; affirmed the *situs* of a vessel for taxation to be at the port of its registry, irrespective of the domicile of the owner; and declared that all negotiable instruments are chattels personal, and the like; until the British system of local taxation, like the French, Belgian, and German, has come to be based on the assessment of comparatively few objects, and the avoidance in assessment, to the greatest possible extent, of all personal inquisition and arbitrary treatment.

A case in question determining definitely, as it would appear, the hitherto questionable *situs* for State taxation of all that large class of personal property comprised under the general term "*negotiable instruments*"—i. e., State, municipal, railroad, and other corporate bonds, circulating notes of banking institutions, promissory notes payable to bearer, etc.—is reported in the fifteenth volume of Wallace, under the title of *State Tax on Foreign-held Bonds*, and in brief may be thus stated:

The State of Pennsylvania, by a law passed in 1868, required the officers of every company, except banks or savings institutions, incorporated and doing business in that State, to retain a tax of "five per cent" upon every dollar of interest paid by such company to its bondholders or other creditors, and to pay over the same to the State Treasurer for the use of the Commonwealth. The plaintiff in this specific case—the Cleveland, Painesville, and Ashtabula Railroad Company—denied the legality of the tax, and, appealing to the State courts, alleged, among other things, the following in support of its position:

"That the greater portion of the bonds of the company having been issued upon loans made and payable out of the State to non-

residents of Pennsylvania, citizens of other States, and being held by them, the act in question, in authorizing the tax upon the interest stipulated in the bonds, so far as it applied to the bonds thus issued and held, impaired the obligation of the contracts between the bondholders and the company, and was therefore repugnant to the Constitution of the United States and void."

The several State courts of Pennsylvania, however, affirmed the validity of the tax; but the case having then been carried on writ of error to the Supreme Court of the United States, the latter in December, 1873, reversed the judgment of the State courts, and decided in favor of the plaintiff; the opinions of the court, as expressed by Mr. Justice Field, being substantially as follows:

I. *The power of taxation of a State is limited to persons, property, and business within her jurisdiction; all taxation must relate to one of these subjects.*

II. *The tax laws of a State can have no extra-territorial operation; nor can any law of a State inconsistent with the terms of a contract made with and payable to parties out of the State have any effect upon the contract while it is in the hands of such parties or other non-residents of the State.*

III. *Bonds issued by a railroad company are property in the hands of the holders, and when held by non-residents of the State in which the company was incorporated are property beyond the jurisdiction of the State.*

It will be observed under the *third* head (the language above quoted being the official prefatory syllabus of the decision) that the court lays down the rule that negotiable bonds are property, not in the place where issued, as was claimed by the authorities of Pennsylvania, and not at the domicile of the owner irrespective of actual presence, as was generally claimed by the State tax officials, *but in the hands of the holders at the place where the bonds are actually situated*, whether the holders be actual, *bona fide* owners or otherwise. And the following is the exact language in which the decision was expressed:

"It is undoubtedly true that the actual *situs* of personal property which has a visible, tangible existence, and not the domicile of its owner, will in many cases determine the State in which it may be taxed. The same theory (i. e., the actual *situs* determinative) is true of public securities consisting of State bonds, and bonds of municipal bodies, and circulating notes of banking institutions; the former, by general usage, have acquired the character of, and are treated as, property in the place *where they are found, though removed from the domicile of the owner*; and the latter are treated and pass as money wherever they are."

If, now, there is any meaning in words, and if the authority of the United States Supreme Court in defining the powers and jurisdiction of the States is as absolute as is generally supposed, it is clearly evident that the first clause of the above-quoted opinion effectually establishes the unconstitutionality and illegality of the theory and practice of Massachusetts and other States, namely, that in virtue of jurisdiction over the person and domicile a State has a right to tax so much of the visible, tangible, personal property of its citizens—i. e., horses, cattle, stocks of goods, money, bullion, and the like—as may be *without its territory and jurisdiction*: the law of Massachusetts, for example, defining personal property for the purpose of taxation to be “goods, chattels, money, and effects, wherever they are.” *

If it be objected that the court, by using the expression “in many cases,” does not make its rule absolute and unqualified, the answer is that the exceptions, when understood, will be found to be of a character which proves and strengthens the rule, rather than antagonizes it. Thus, as has been already noticed, the United States Supreme Court has decided that the *situs* for taxation of vessels which move about on the high seas or navigable inland waters must be at the home port where they are owned and registered; and it also stands to reason that the *situs* of such property as railroad cars, or other chattels which as a condition of using are perpetually *in transitu*, in order to avoid duplicate taxation and conflicting statutes, must be taxed, if taxed at all, under the head of the franchise of the company or owners. But in all cases where fixity, or permanence are conditions of using, it may be unquestionably affirmed that the court intended to make no exception in its rule for determining where visible, tangible, personal property may be taxed, and where, also, it is of necessity exempted from taxation.

TAXATION AND PROTECTION CORRELATIVE.—It ought to be superfluous, but in view of existing opinions and practices it is nevertheless expedient to say that the reason of this rule is founded upon a circumstance alike conformable to law and common sense, which is that taxation and protection are correlative terms; or, in other words, according to the political theory of our governments, national and State, and, in fact, of every government claiming to be free, that taxes are the compensation which property pays to the State for protection; or, as Montesquieu, in his *Spirit of Laws*, has

* In Massachusetts, within the last half century, a citizen has been threatened with arrest and imprisonment for objecting to pay taxes in that State on goods located in a store in San Francisco and paying taxes thereon in the State of California. Bullion in the vaults of the Bank of England has also been taxed to citizens of Massachusetts as personal property within a comparatively recent period.

it, and as the United States courts have again and again expressed it, that "the public revenues are a portion that each subject gives of his property in order to secure and enjoy the remainder." When, therefore, a State like Massachusetts assesses property situated beyond its territory and jurisdiction, and which its laws are not competent or able to either reach or to protect, or assesses one of its own citizens in respect to such property, the act has no claim to be regarded as taxation, but is simply arbitrary taking, or confiscation, and a procedure which the United States Supreme Court has, at least in the case under consideration, declared to be unconstitutional, and therefore illegal and unwarranted. But the Supreme Court of the United States has placed itself on record before in respect to the principle that protection and taxation are correlative; and in another case, which appears almost wholly to have escaped the attention of the American bar and public, its decision is invested with a historical as well as a legal interest. Thus, in September, 1814, the country being then at war with Great Britain, the town of Castine in Maine was captured by the British, and remained in their exclusive possession until after the ratification of peace, in 1815. During this period the British Government exercised all civil and military authority over the place; established a customhouse, and allowed goods to be imported, which goods remained in Castine after it was evacuated by the enemy. After the re-establishment of the American Government, however, the United States collector of customs, claiming a right to American duties on the goods in question, demanded payment of the same from the owners or importers, and, the claim being resisted, the case went up to the Supreme Court, where Judge Story, then upon the bench, gave judgment for the defendants as follows:

"We are all of the opinion that the claim for duties can not be sustained. By the conquest and military occupation of Castine, the enemy acquired that firm possession which enabled him to exercise the fullest rights of sovereignty over that place. The sovereignty of the United States over the territory was of course suspended, and the laws of the United States could no longer be rightfully enforced there, or be obligatory upon the inhabitants who remained there and submitted to the conquerors. By the surrender, the inhabitants passed under a temporary allegiance to the British Government, and were bound by such laws, and such only, as it chose to recognize and impose. From the nature of the case, no other laws could be obligatory on them; *for where there is no protection, or allegiance, or sovereignty, there can be no claim to obedience.*"

But to return to the subject more immediately under consideration. The court having thus affirmed the *situs* for the taxation of

personal property which has a visible and tangible existence, has now taken a further step forward, and in the second clause of the opinion above quoted asserts that "the same thing is true of public securities consisting of State bonds, and bonds of municipal bodies, and circulating notes of banking institutions"; namely, that their *situs* for assessment and taxation is wholly irrespective and apart from any whereabouts of the owner or his domicile, but is where the securities actually are. So much, then, is so clear that even the most obstinate of assessors under the present arbitrary system will find it difficult, in respect to the items specified, to interpret the law and rule of action otherwise. But it is to be observed that negotiable railroad bonds are not, in the opinion quoted, specifically mentioned.

That they, however, follow the same law as municipal and State bonds, and were intended by the court to be included in the same category, is, however, obvious, for the following reasons:

1. The subject-matter of the case and of the decision was a railroad bond.

2. The character of a railroad bond as a negotiable instrument is in all respects the same as a State or municipal bond.

3. The reason which undoubtedly led the court (as it must every unprejudiced reader who thinks upon the subject) to the conclusion that State, municipal, and railroad bonds and bank notes follow the same rule, in respect to their *situs* for taxation, as other personal property of acknowledged visible and tangible character is that the property of all such instruments runs with the instrument, wholly irrespective of the residence of the owner, and consequently, in respect to title, passes by delivery. By public securities, also, the court undoubtedly meant all negotiable securities which are payable to the public—that is, to bearer wherever he may be; or, in other words, a public security, from its very nature, is subject to no previous equities between the original parties creating or issuing it, and the sum agreed to be paid is a liquidated and adjusted sum which must be paid to the public—that is, the holder; and the *situs* of such property from necessity follows the instrument to the public, and can be nowhere else than where the instrument actually is. On the other hand, if the instrument was subject to equities, the property might be where the parties creating it or owning it resided. And if this position is not correct, dealings in all such securities, or upon the stock exchange, or in open market would be impracticable; inasmuch as the purchaser would be obliged to institute an investigation as to whether the title for each specific bond vested in the vendor or some other person; and as there is no registration of the transfer of such property, as there is in the case of real estate, the

investigation must be practically impossible. So, also, in the case of circulating notes of banking institutions: if their title did not pass by delivery, or, in other words, if their *situs* as property was not under all circumstances accepted as in the hand of the holder, their use as money would be impossible; and the courts, recognizing this principle most fully, have always held that in cases where negotiable instruments or money have been stolen, and in consideration for value received have come into the hands of innocent third parties, the title to such property in the hands of the holders is perfect and irrevocable.

Again, the circumstance that State, municipal, and railroad bonds, and all other strictly negotiable instruments, even warehouse receipts payable to bearer, are subject to attachment by legal process only at the place where they actually are, and without regard to the whereabouts of the owner or his domicile, of itself also clearly defines and limits the *situs* of such property for taxation; for clearly a State which has the power to make a legal attachment operative against a given property has also the power to tax such property; while, on the other hand, a State which through lack of possession and jurisdiction, can not attach a specific property, certainly can not enforce its tax laws against it, or give protection in case its rights or the rights of its owner are violated. And, again, can the right to tax personal property exist in a State from which the property is so confessedly absent that there is neither right, power, nor possibility of passing title to it within the territory of the State by delivery?

That the view thus taken respecting the *situs* of negotiable instruments, and especially of railroad mortgage bonds, for taxation, is in strict conformity with the opinion of the Supreme Court, is also evident from the fact that in summing up the court held that not only was a mortgage bond issued by a railroad chartered by Pennsylvania, and in the hands of a non-resident, property out of the State, and as such beyond the jurisdiction of the taxing power of the State, but also that the State could not tax such property even when owned by a citizen and resident, unless the bond was at the time of assessment actually within the territory of the State. And as this point is a most important one, it is desirable to ask attention to the exact language of the court establishing it.

"We are clear," says Justice Field, "that the tax can not be sustained; that the bonds, being held by non-residents of the State, are only property in their hands, and that they are thus beyond the jurisdiction of the taxing power of the State. *Even where the bonds are held by residents of the State*, the retention by the company of a portion of the stipulated interest can only be sustained as a mode of

collecting a tax upon that species of property in the State. When the property is out of the State, there can be no tax upon it for which interest can be retained. The tax laws of Pennsylvania can have no extra-territorial operation."

The decision of the United States Supreme Court, of which an analysis has been above given, ought therefore to be regarded as constituting a real chapter of progress in American local taxation; because, by contributing powerfully to break down the present popular system, which, founded on an erroneous and impracticable principle, never has been and never can be executed with justice and efficiency, the time is thereby hastened when a better system shall be accepted and inaugurated. The logic of this decision, moreover, will not only pervade courts—State and Federal—but will be felt in legislative halls, and be impressed upon the conscience of the people. The court itself, in referring to the tax under consideration, says with great point and truth: "*It is only one of many cases where, under the name of taxation, an oppressive exaction is made, without constitutional warrant, amounting to little less than an arbitrary seizure of private property. It is, in fact, a forced contribution levied upon property held in other States, where it is subjected, or may be subjected, to taxation upon an estimate of its full value.*"

But this new decision teaches us that all personal property, if taxed at all, must be taxed in the city or town where found, and not elsewhere. The injustice and oppression are also the same as in the case of State exterritorial taxation when the tax is levied upon a person for property not within the district where the property is actually located and protected. It is only a degree of oppression, and this authoritative opinion of the United States Supreme Court can not fail to give a new impulse to the feeling that taxation without protection is merely legalized brigandage.

"WHY do we study animals at all?" asks Prof. L. C. Miall, in his British Association address. "Some of us merely want to gain practical skill before attempting to master the structure of the human body; others hope to qualify themselves to answer the questions of geologists and farmers; a very few wish to satisfy their natural curiosity about the creatures which they find in the wood, the field, or the sea. But surely our chief reason for studying animals ought to be that we would know more of life, of the modes of growth of individuals and races, of the causes of decay and extinction, of the adaptation of living organisms to their surroundings. Some of us aspire to know in outline the course of life upon the earth, and to learn or, failing that, to conjecture, how life originated. Our own life is the thing of all others which interests us most deeply, but everything interests us which throws even a faint and reflected light upon human life."

ABORIGINES OF THE WEST INDIES.

BY LADY EDITH BLAKE.

SOME little interest having again been awakened in the outside world concerning the West Indian Islands, the question is occasionally asked, Had those islands any aborigines when discovered by Europeans? If there were natives, do any of them remain? Both questions may be answered in the affirmative. The West Indies, or Antilles, consist of many hundreds, or even—reckoning keys or very small islands—several thousand islands varying in area from those which, like Cuba and Jamaica, number their square acres by the million, to the tiny key of half an acre or less. The greater number of these—indeed, all capable of supporting a population, with the exception of Barbados—contained inhabitants when first discovered. Barbados, though containing numerous evidences of former occupation, was uninhabited when taken possession of by its first European settlers, the English.

The peculiar interest attaching to the meeting between the European navigators and the Western barbarians is that—putting aside the discoveries of the Northmen in the tenth and eleventh centuries—it is the first meeting between modern and prehistoric man of which we have any account. Till the beginning of the nineteenth century the civilized world knew little or nothing of prehistoric man, and prehistoric anthropology was an unknown science. To have stated that man had existed on the earth more than four thousand years B. C. would have been regarded as heresy, and to have held that he had roamed over Europe when the mammoth crashed through its forests, and when the stately megaceros and reindeer browsed on its bogs, would have been considered the wildest folly. The stronger light that is being thrown on those times of long ago first shone in Denmark, where the study of runic stones and characters led to the disclosure of evidences of human occupation of that country far earlier than had ever heretofore been suspected. Subsequently, the finds at Abbeville, the discovery of the lake dwellings in Switzerland, the investigations in the caves of Kirkdale and Kent's Hole in England, with others too numerous to mention, awoke widespread interest in the newly arisen branch of investigation; learned men began to compare the remains and relics of the aborigines of America with those of Europe, and at length began to recognize that when Columbus landed on Guanahani, and was met by its painted and trembling inhabitants, the people of the Old World, instead of finding men of a new kind, were in reality standing face to face with men such as in Europe had been extinct for nigh two thousand years. This it

is that gives such fascination to the descriptions left us by those who first saw men who were living very much as must have done the owners of the Cro-Magnon and Neanderthal skulls, and that lends such peculiar interest to all vestiges and traces that have been preserved of a people secluded from all contact with those more enlightened than themselves.

Fortunately, there is considerable material available for so interesting a study. Besides relics of the aborigines in the shape of skulls, bones, stone and wooden implements, and rock-carvings, some of which are more or less abundant in most of the islands, the early writers have left us graphic descriptions of these people, their manners and customs; and they give us the facts as they passed before their eyes, without any endeavor to bend such facts to the support of their own pet theory, or to explain what they did not understand, save by the usual and satisfactory method of assigning everything of which they disapproved or for which they could not account to the agency of the devil.

It is indeed fortunate that the discoverers have given us so many details of what they saw in those beautiful islands, which they flattered themselves were the outposts of the empire of the Great Khan, for the people they saw there have long since passed away, leaving no posterity behind them, save in the case of the Caribs of Dominica and St. Vincent. The Lucayans of the Bahamas, the Arrowauks of Cuba and the larger Antilles have for the last three hundred years or so been extinct. It is true that at Parottee Point, in Jamaica, a few of the fishermen claim to have Indian blood in their veins, and one old man assured me he was a pure Indian by descent. These people had straight black hair, and were decidedly different in feature to their negro neighbors. However, in all probability the Indian element is accounted for by Indians having not infrequently been brought to Jamaica either from the Mosquito coast or Florida. Sir Hans Sloane, who came to Jamaica more than two centuries ago as physician to the Duke of Albemarle, speaks of Indians there—

not natives of the island, they being all destroyed by the Spaniards, but are usually brought by surprise from the Mosquitos or from Florida, or such as were slaves to the Spaniards and taken from them by the English. They are very good hunters and fishers, but are naught at working in the field or slavish work, and if checked or drubbed are good for nothing, therefore are very gently treated and well fed.

Curiously enough, at the present day the people claiming Indian descent in Jamaica are still expert fishermen.

I was informed by General Légitime, ex-President of Haiti, that in that island, in the wild, forest-clad mountains beyond Jacmel, people live in the woods who never visit the towns or hold any com-

munication with the present owners of the island, and who are believed to be descendants of the native Indians. It would be interesting if some communication with these people could be established, but meantime it is as likely they may be Maroons as Indians, for all concerning them is too vague and uncertain to allow at present of their being regarded as representatives of the aborigines.

In Dominica, St. Vincent, and Trinidad a few of the primitive inhabitants still remain. They are Caribs, who were a fierce and warlike race, the bitter enemies and persecutors of the comparatively mild and inoffensive Arrowauks. Both tribes still exist in Guiana, and apparently have forgotten their old differences. It is probable that the Arrowauks were the earliest arrivals in the islands, but when their migration from the mainland took place there are not sufficient data for saying: all we know is that it must have been long ages before the arrival of the Europeans. In Hispaniola (now the negro republics of Haiti and Santo Domingo) the absence of any legend of a distant origin would allow of the native Indians having had a legitimate claim to being an autochthonous race, or at any rate points to the great length of time that must have passed since their canoes had carried them across the breezy Caribbean Sea, from the cradle of their race far away in the dense and mysterious forests of South America. The Indians of Hispaniola, like many others of their brethren, handed down their histories and traditions in songs which were chanted before the people on festivals and other great occasions, and which were often accompanied by dances. On great occasions they danced to the sound of a drum made out of the trunk of a tree and played by a cacique. In these songs or hymns the tradition was recorded that the first men came out of two caverns in the island. The sun was irritated at the advent of mankind, so changed the guardians of the caves into stones, and metamorphosed the men who had escaped from the caves into trees, frogs, and different animals. In spite, however, of these efforts on the part of the great luminary, the world became peopled. Another tradition declared that the sun and moon themselves had come out of a cavern in Haiti.

The traditions of the Lucayans, on the contrary, all pointed to the Lucayans having come to those islands from a land to the south, so probably their residence in the Bahamas had not been for so long a period as to blot out all recollection of the large islands where their race had struck such firm root on its migration from the mainland. That the Arrowauk occupation of the islands had been of long duration, a mass of evidence appears to show. In Cuba artificially flattened skulls have been discovered imbedded in lime rock in caves near Cape Maisi. With them were found fragments of pottery, an

earthen jar containing bones, and some stone axes or celts, popularly known as "thunderbolts." In Jamaica we ourselves found pottery and bones imbedded in a cave in the rocks, out of which we had to break them with a machete, or cutlass. In the Jamaica cave, however, the lime in which the bones were incrustated appeared to be of stalactitic nature, and may have been deposited more rapidly than would have been the formation of true limestone. The district in which the cave is situated (the St. John's Hills, Guanaboa) is a very dry one, and there was no appearance of any drip from the roof or sides of the cave when we visited it; so it may be assumed that the incrustation must, in any case, have been a slow process. The Indians had been exterminated in Jamaica for a considerable period before its occupation by the English, which took place in the days of Cromwell, so even a low computation of the lapse of time must assign a respectable antiquity to the incrustated pottery and bones. When more extensive researches and explorations take place, it is possible that traces of human presence may be discovered in some of the older rocks or strata of some of the islands.

That all the larger islands were inhabited by a race which was divided into tribes, some of which spoke different dialects, but which derived their origin from the same stock, is shown not alone from evidence afforded by skulls, pottery, and implements, but from the fact of identity of language. On Columbus's first voyage he carried home with him some of the natives to exhibit in Spain. Among these was a boy named Didacus, taken by the admiral from Guanahani, now generally known as Watling's Island, the scene of the landfall. We are told that Didacus "was a man from his child's age, brought up with the admiral." Later on he sailed with Columbus back to the Antilles and acted as his interpreter, and eventually Guarionexius, the King of Cibana (in Hispaniola), in order to secure to himself the friendship of Columbus, gave his sister as wife to Didacus. In most of the islands Didacus appears to have understood the language with ease, and when he failed to do so the fact is expressly stated. This was the case at one end of Cuba.

But here [writes the old chronicler] Didacus, the interpreter, which understood the language of the beginning of Cuba, understood not them one whit; whereby they [the Spaniards] considered that in many provinces of Cuba were sundry languages.

Who these people were whose tongue was incomprehensible to a Lucayan, who spoke the Arrowauk language, we have no means of judging. As Didacus could not understand these people "one whit," the difference in their tongue from that of the generality of the Arrowauk descendants must have been very great, more so apparently than that of a diversity of *patois* or of accent. This seems

to point to the fact that there were other Indians living in some of the islands besides Arrowauks and Caribs. We know that from time to time Indian traders from the mainland visited the islands, and some of them may have remained and settled in them. On his fourth voyage Columbus met some of these trading canoes, and Peter Martyr gives a detailed account of the event from a letter written by Columbus himself.

Leaving the islands of Cuba and Jamaica on his right hand toward the north, he [Columbus] writeth that he chanced upon an island more southward than Jamaica, which the inhabitants call Guamassa, so flourishing and fruitful that it might seem an earthly paradise. Coasting along by the shores of this island, he met two of the canoes or boats of those provinces, which were drawn of two naked slaves against the stream. In these boats were carried a ruler of the island, with his wife and children, all naked. The slaves, seeing our men aland, made signs to them to stand out of the way, and threatened them if they would not give place. Their simpleness is such that they neither feared the multitude or power of our men, or the greatness and strangeness of our ships. They thought that our men would have honored their master with like reverence as they did. Our men had intelligence at the length that this ruler was a great merchant, which came to the mart from other coasts of the island, for they exercise buying and selling by exchange with their confines. He had also with him good store of such ware as they stand in need of, or take pleasure in : as laton bells, razors, knives, and hatchets, made of a certain sharp yellow stone, with handles of a strong kind of wood ; also many other necessary instruments, with kitchen stuff, and vessels for all necessary uses ; likewise sheets of gossampine cotton, wrought of sundry colors. Our men took him prisoner, with all his family, but Columbus commanded him to be loosed shortly after, and the greatest part of his goods to be restored to win his friendship.

The Arrowauks were ignorant of the working of metals, so the mention of "laton bells" as part of the stock in trade of this roving trader points to his having come from the mainland, where the Zuñis, Aztecs, Mayas, and Peruvians were all workers of bronze, or laton, though they had not progressed so far as the use of iron.

That the Caribs were later comers in the Antilles than the Arrowauks seems likely from the fact that they had only established themselves in the smaller islands, and made thence raids on the inhabitants of the larger ones; for it is highly improbable that, had so fierce and domineering a people had time to increase and multiply, they would have left their weaker neighbors in possession of all the larger islands, though it is possible they regarded the latter as stock farms whence to draw supplies for their larders. Some authors even assert that the arrival of Caribs in the islands could only have shortly preceded the Columban discovery. The Spaniards were astonished to observe that the Carib women spoke a different lan-

guage from the men. The Caribs did not kill or eat the women whose tribes they attacked. The young women, says Martyr, "they take to keep for increase, as we do hens to lay eggs; the old women they make their drudges." Alluding to this fact, and discussing the probable date of the arrival of the Caribs in the West Indian Archipelago, Dr. D. G. Brinton says:

The latter event was then of such recent occurrence that the women of the island Caribs, most of whom had been captured from Arowaks, *still spoke that tongue*.

The comparatively mild and inoffensive Arrowauks must have had a bad time of it when the Caribs were on the war path in those lovely islands, about which Martyr writes so enthusiastically as "an earthly paradise," where

was never any noisome beast found in it, nor yet any ravening four-footed beast: no lion, no bear, no fierce tygers, no crafty foxes, nor devouring wolves. All things are blessed and fortunate,

exclaims he, writing of Hispaniola; but the human enemy, more relentless and deadly than four-footed beast, must have been a blighting factor in the happiness of the daily life of the Arrowauk, even before the arrival of Spanish oppressors. "They of the islands," writes the old monk, ignoring his having pronounced all things there "blessed and fortunate,"

when they perceive the cannibals coming have no other shift but only to flee, for although they use very sharp arrows made of reeds, yet are they of small force to repress the fury of the cannibals, for even they themselves confess that ten of the cannibals are able to overcome a hundred of them if they encounter with them.

Cruel as were the Spaniards to the unfortunate Indians in general, to the Arrowauks they must at first have appeared almost as benefactors compared to the Caribs, and indeed the more severe enactments of the conquerors were avowedly directed against those Indians "guilty of that unnatural crime" of eating human flesh.

Nowadays that travelers in Africa, New Zealand, the Pacific, and elsewhere have made us familiar with stories of cannibalism as a widespread practice among savage peoples, and that research has shown us that in prehistoric times it may not have been unknown even in Europe, we often fail to appreciate the horror and astonishment with which so strange and revolting a habit filled the early Spanish navigators. It came upon them as a shock, a horror which was a novelty, and therefore all the more abominable. We are always apt to overlook cruelties and evils with which we are familiar, while rarely failing to be scandalized at those that are new to us. The Spaniards were not squeamish about cruelty, and indeed the

word can not be applied to cannibalism, for once a man is dead it is not more cruel to eat his body than to bury or burn it.

The Inquisition had made the Spaniards callous to barbarity, but cannibalism was a different matter; they were not accustomed to it, had never before met with it. Rough sailors, relentless bigots as they were, who at home doubtless would have attended a bullfight or an *auto-da-fe* with equal pleasure, they could not stomach cannibalism, and it was with loathing and unspeakable disgust that in the round, bell-like houses of an Indian village they often found

in their kitchens man's flesh, duck's flesh, and goose flesh, all in one pot, and other on the spits ready to be laid on the fire. Entering into their inner lodgings, they found fagots of the bones of men's arms and legs, which they reserve to make heads for their arrows, because they lack iron; the other bones they cast away when they have eaten the flesh. They found likewise the head of a young man fastened to a post, and yet bleeding.

By the people supposed to be of Arrowauk descent the Spaniards were generally received with submission and fear, the people mistaking them for Caribs, except in a part of Jamaica, where the inhabitants at first offered a feeble resistance. In some instances the new arrivals were even worshiped as gods. Such was the case in the Bahamas and in Haiti, where ancient prophecies had taught the Indians to expect the arrival of

Maguacochios—i. e., men clothed in apparel, and armed with such swords as should cut a man in sunder at one stroke, under whose yoke their posterity should be subdued.

The existence of these prophecies seems not to have excited any great surprise or to have caused much speculation as to their origin in the minds of the Spaniards. Such apparently miraculous foresight on the part of the Indians the new arrivals easily, and to themselves satisfactorily, accounted for by the fact that the barbarians were worshipers of the Evil One, and that their priests and idols, or zemis, were enabled to prophesy because of their intercourse and familiarity with devils. But, notwithstanding much that was objectionable and false, the creed of the Indians does not appear to have been altogether debased, and as explained to Columbus by one of the old chieftains of Cuba, the doctrines of those remote and benighted savages might claim some affinity to those professed by the Christians. Columbus and his men had landed and were hearing mass on the Cuban shore when "there came toward him a certain governor, a man of fourscore years of age, and of great gravity, although he were naked," and who

had a great train of men waiting on him. All the while the priest was at mass he showed himself very humble, and gave reverent attendance with grave and demure countenance.

When mass was over the old chief "presented to the admiral a casket of the fruits of his country, delivering the same with his own hands." After Columbus had "gently entertained him," the old man made a speech, which Didacus, the interpreter, translated to the Spaniards to the following effect:

I have been advertised (most mighty prince) that you have of late with great power subdued many lands and regions hitherto unknown to you, and have brought no little fear upon all the people and inhabitants of the same: the which your good fortune you shall bear with less insolency, if you remember that the souls of men have two journeys after they are departed from this body. The one, foul and dark, prepared for such as are injurious and cruel to mankind; the other, pleasant and delectable, ordained for them which in their lifetime loved peace and quietness. If therefore you acknowledge yourself to be mortal, and consider that every man shall receive condign reward or punishment for such things as he hath done in this life, you will wrongfully hurt no man.

Columbus,

marveling at the judgment of the naked old man, answered that he was glad to hear his opinion as touching the sundry journeys and rewards of souls departed from the bodies, supposing that neither he or any other of the inhabitants of those regions had had any knowledge thereof; declaring further that the chief cause of his coming thither was to instruct them in such godly knowledge and true religion . . . and especially to subdue and punish the cannibals and such other mischievous people, and to defend innocents against the violence of evildoers, etc.

The old man was so pleased with these comfortable words of the admiral that he became desirous of forsaking Cuba and accompanying Columbus to Spain, "notwithstanding his extreme age," and was with difficulty deterred from the purpose by his wife and children, who fell prostrate at the feet of the old cacique, imploring him with tears not to forsake and leave them desolate.

At whose pitiful requests the worthy old man, being moved, remained at home, to the comfort of his people and family, satisfying rather them than himself; for, not yet ceasing to wonder, and of heavy countenance because he might not depart, he demanded oftentimes if that land was not heaven which brought forth such men.

The Caribs were of different mettle from the inhabitants of the larger islands. They resisted to their utmost, and sometimes, without waiting to be assailed, attacked the Spaniards even at sea. In the Gulf of Paria we read that the Spanish vessels met with

a navy of eighteen canoes of cannibals, which went a-roving to hunt for men, who, as soon as they had espied our men, assailed their ship (that of Petrus Alphonsus, called Uignus) fiercely, and without fear inclosed the same, disturbing our men on every side with their arrows.

But, courageous as they were, the novel terror of the flash and smoke and thunder of the guns struck consternation into the daring cannibals, who turned and fled before the unexpected and alarming fire and fury of the cannon. The Spaniards gave chase and captured one of the canoes; in it was only one Carib; his companion or companions had escaped, but in the piragua lay a captive tied and bound, who, with tears running down his cheeks, made the Spaniards understand by gestures that six of his comrades had already been killed and eaten, and that such was to have been his own fate on the following day. The Spaniards unbound the prisoner and

gave him power over the cannibal to do with him what he would. Then, with the cannibal's own club, he laid on him all that he might drive hand and foot, grieving and fretting as it had been a wild boar, thinking that he had not yet sufficiently revenged the death of his companions when he had beaten out the brains and guts.

Speaking of the Caribs of the mainland, the old writer says: "That wild kind of men, dispersed through the large distance of those coasts, hath sometimes slain whole armies of the Spaniards." Indeed, the Caribs even mocked at their invaders, designating them as women or children, in ridicule of their white teeth, those of the Caribs "being black as coals, from a leaf they chewed."

The Arrowauks were taller than the Caribs, but not so robust, in color of a clear brown, their complexion, according to Columbus, not being much darker than that of a Spanish peasant. Both Arrowauks and Caribs flattened their heads, though each race had a different fashion of doing so.

By this practice [says Herrera] the crown was so strengthened that a Spanish broadsword, instead of cleaving the skull at a stroke, would frequently break short upon it.

Various reasons have been assigned for the singular fashion of flattening the head that obtained throughout the Antilles. It is said that infants whose heads are so treated do not cry or moan as do babies whose heads are left to Nature; but if, as some anatomists affirm, the coronal sutures in the heads of infants born in the West Indies are exceptionally open, the strengthening of the skull was probably the reason that had originally brought flattened foreheads into fashion. The practice, it is believed, does not lessen the intelligence of the bearer of the flattened head, and if it has any effect on the brain it would be in the direction of subduing "speculative and emotional energy," while developing activity of limb. Their hair, like that of Indians in general, was straight, coarse, and black; their features were hard and ugly; they had broad faces and flat noses, but their eyes showed great good nature, and their countenances were open and pleasing.

It was an honest face [says Martyr], coarse but not gloomy, for it was enlivened by confidence and softened by compassion.

Their wants were few, and sea and land furnished them with the necessities of life, without exacting any severe or continuous labor on their part; so, as is almost invariably the case with natives of the tropics, the Arrowauks were indolent and indisposed to hard work, though showing considerable energy in their amusements, as we are told that "it was their custom to dance from evening to dawn." Another of their favorite pastimes was the game of *balo*, said somewhat to have resembled cricket. The players were divided into two sides, which alternately changed places. The ball with which they played was made of India rubber from the native milk withy, and the elastic nature of the material was a surprise to the Spaniards, who heretofore had not seen India rubber. Both men and women took part in the game; the ball was not caught with the hand, but received on head, elbow, or foot, and repelled with great force and dexterity. Wrestling and running for prizes were also well-known amusements among these people.

The great defect of the Arrowauks was their extreme immorality. Some of their dances were exceedingly indecent and disgusting, and the more abandoned a woman was, the greater was the consideration in which she was held. The religions and beliefs of the Indians varied more or less with the different tribes and races among them, and no doubt the Arrowauks had a variety of sects and formulas in the different islands. In broad lines we gather that they believed in a supreme being called Jocahuma, who had a father and mother residing sometimes in the sun and sometimes in the moon. Divine honors were also paid to images of wood, stone, and cotton, called *zemis*, which represented usually distorted versions of the human face and sometimes reptiles. A consecrated hut or temple was set apart in every village for worship of these *zemis*, but only the priests or Bohitos were permitted to enter these temples, and they acted as intercessors for the people, besides practicing the art of medicine and superintending the education of the children of caciques and men of high rank. When the will of the cacique had received the approval of the Bohito or priest, it was received by the people as the decree of Heaven.

The spirits of the good were believed to go to a pleasant valley called Cozaba. There, surrounded by leafy trees laden with delicious fruits, the islanders looked forward to rejoining the spirits of their ancestors, and in cool shade beside flowing rivulets to rejoice in the society of the friends they had loved in the islands of earth, in a land where there were no hurricanes, no drought, and no Caribs. Each tribe appears to have considered that this paradise was situated

in some mysterious way within their own province. During the day the souls of the departed hid themselves in the fastnesses of the mountains, but in the soft, fragrant tropical nights the souls were said to emerge from their retreat and to come down to the valley, to feed upon the fruit of the glossy-leaved mammee. This tree was consequently deemed sacred by the Indians, who refrained from eating the fruit lest the spirits of their ancestors might want food.

Of course, there were many variations in the rituals and beliefs of the religions of the various tribes. It would be as impossible to attempt an account even pretending to be comprehensive of their creed, in the space of a few pages, as it would be to do so of the churches and sects of Christianity; but such, in broad lines, is the sketch left us by the Spanish writers of the faith of the peoples of the Greater Antilles. Accounts of creeds given by opponents of the religion are, of course, always liable to misconceptions and perversions. The Indians, on their side, seem often to have been under the impression that the object worshiped and invoked by the Spaniards was gold, and not the Trinity. Gold they already regarded with a certain reverence, apparently esteeming it a sacred thing, as before setting out to seek for it they underwent a certain course of abstinence and fasting.

Hatuey, a cacique of Santo Domingo, had emigrated thence with his people to Cuba, in order to escape from the tyranny of the Europeans. The Spaniards pursued the fugitives, and the cacique exhorted his followers to resist to the uttermost, but pointed out to them that no bravery of theirs could prevail unless they invoked and conciliated the god of the Spaniards, who had shown himself to be so powerful, and in whose honor their enemies were ready to embark on any enterprise.

Behold him [exclaimed Hatuey, showing his men a basketful of gold], behold that god for whom they undertake so much; it is for him they came here. Let us, then, celebrate a feast in his honor, to obtain his protection.

Thereupon the Indians began their sacred songs, all the while dancing around the gold. Hatuey, however, declared that they could not be safe so long as the god of the Spaniards remained in their neighborhood, and that he should be buried where he could never be discovered. Amid shouts of joy from the people the gold was then cast into the sea. But, unfortunately for the Indians, his power was not so easily allayed as that of their zemis. The Spaniards came, the cacique fell into their hands, and was condemned to be burned alive. As he was being tied to the stake a Franciscan friar drew near and attempted his conversion, telling Hatuey of the heaven and hell of the Christians. "In this place of happiness

whereof you speak," said the cacique, "are there any Spaniards?" "Assuredly," answered the missionary, "but only good ones." "The best of them were good for nothing," replied Hatuey, "and I desire not to go where I may be in danger of meeting with one of that horrid tribe."

"Les grands mangeurs de viande sont en général cruels et féroces, plus que les autres hommes; cette observation est de tous les lieux," writes Rousseau, and the difference in the disposition of the Arrowauks and Caribs bears out the truth of the remark. The Arrowauks had little animal food, with the exception of fish, a few birds, reptiles, and insects; but the Carib larders were kept well furnished with human flesh, and even if an expedition had failed to bring back men prisoners for the table (women were not eaten), they had preserves of children taken in former raids, and fattened up till they were plump enough to be irresistible to any cannibal palate.

But though on festival occasions they no doubt gorged themselves both with meat and drink, as a rule, like Indians in general, they were very abstemious. Indeed, the Spaniards, although the most abstemious of Europeans, to the Indians—"whose abstemiousness," says an old writer, "exceeded that of the most mortified hermit"—appeared excessively voracious. So surprised were they at the appetites of the Spaniards—one of whom was supposed to consume as much as ten Indians—that the islanders were of opinion that the Spaniards must have come among them in quest of food, their own country not producing enough to satisfy such immoderate appetites—a conclusion which Carib manners and customs would certainly assist in forming.

Both Arrowauks and Caribs were fond of smoking. They intoxicated themselves with tobacco, which they called *cohiba*, drawing up the fumes by a tube through the nostrils. A dream coming during the ensuing intoxication was regarded as an inspiration.

Though usually shorter than the Arrowauks, the Caribs were strong and muscular, active and lithe. To our eyes their appearance would have been anything but pleasing. In their cheeks and ears they made deep incisions, which were rendered conspicuous by being stained black; their faces and bodies were painted red with annatto, and round their eyes they were distinguished by circles of black and white. Some of the greater dandies pierced the cartilage of the nose, and inserted therein the bone of a fish, a piece of tortoise shell, or a parrot's feather. Instead of shells they strung together the teeth of their enemies slain in battle, whenever such could be obtained, and wore them round their arms and legs. Their arrows were usually poisoned, and when attacking an enemy by night the arrows were often tipped with cotton dipped in oil and set alight, in

order to fire the dwellings they assailed. When a male child was born it was sprinkled with some drops of the father's blood, and as the child grew older it was if possible anointed with the fat of a slaughtered Arrowauk. When the boy entered manhood he had to undergo excruciating tortures in order to prove his prowess and claim to be accounted a warrior. They were not unskillful in the few arts with which they were conversant; they wove cotton and dyed it of various colors, red being the favorite color of the Caribs; they made pottery and burned it in a rough kiln, the shapes of some of their vessels being artistic and pleasing. They were particularly clever in weaving baskets of palmetto leaves, an art still retained by the Caribs of Dominica and St. Vincent, whose beautifully dyed and woven baskets are fashioned with such cunning that they will even hold water. Like the Arrowauks, they believed in future states of bliss or woe. In the former the braves were to enjoy supreme felicity with their wives and captives, while the spirits of cowards were to be banished eternally beyond the mountains, and doomed to everlasting toil in captivity to the Arrowauks. In every hut there was an altar made of banana leaves and reeds, on which they placed the earliest fruits and choice viands. Demons and evil spirits were dreaded and worshiped, and sacrifices offered to them by the hands of their Boyez, or magicians, the worshipers on such occasions wounding themselves by instruments made of the teeth of the agouti.

We can picture the depredations caused by the incessant marauding of bands of these ferocious cannibals, and the terror they must have excited in the minds of the milder islanders. Peter Martyr tells us that in his time alone more than five thousand men had been taken from the island of Sancti Johannis to be eaten. Even after the Caribs had abandoned cannibalism they continued a fierce and desperate people, shunned and dreaded by Arrowauks and Europeans alike, and when cannibalism had ceased to be an everyday matter it would break out every now and then when occasion arose. The establishment of Spanish rule and the disappearance of the Arrowauks must have been the main factors in the decline of cannibalism, but before such was the case the Caribs seem to have given up the practice in some places. Thus Herrera says that "those of St. Croix and Dominica were greatly addicted to predatory excursions, hunting men," but not long before he wrote the Caribs of Dominica had eaten a poor monk, "and he so disagreed with them that many died, and that for a time they left off eating human flesh, making expeditions instead to carry off cows and mares."

When the English began to settle in the smaller Antilles they found the still unconquered Caribs a formidable obstacle to their

peace, and they must have been a difficulty to be reckoned with till the close of the seventeenth century at least.

It is difficult to judge what were the number of the inhabitants of the islands at the time of the discovery. In 1495, when the Indians of Hispaniola rose against Columbus, according to the Spaniards, the number who revolted was a hundred thousand. Some authors place the native population of Hispaniola as high as three millions. It must have been impossible for the invaders to have formed any accurate computation of the number of inhabitants in countries so mountainous and impenetrable as were the larger Antilles. However, all accounts agree that the Indians were very numerous, and Las Casas describes the islands as "abounding with inhabitants, as an anthill with ants."

It seems extraordinary how so numerous a people could have been exterminated in so comparatively short a time. Oppression and cruelty alone could not have succeeded in wiping them out so completely. The Caribs were treated with greater severity than the Arrowauks, and their numbers were small in comparison with their less warlike neighbors, and yet the race survives to this day in Dominica and St. Vincent. Probably there was an inherent weakness in the race itself that tended to its destruction. They were timid and vicious, and timidity and vice are qualities that must hasten the disappearance of any people. Famine and disease seem to have been the chief factors in blotting out the Arrowauks. In Hispaniola the Indians, hoping to rid themselves of the voracious Spaniards, refused any longer to sow any crops. The Spaniards do not seem to have suffered as was expected, but in a few months no less than a third of the number of Indians in that island are said to have perished from starvation. But in 1518, according to Herrera, a scourge appeared in the Greater Antilles that almost desolated them. We know how great are the ravages of any imported disease among barbarians.

In our own days the natives of Fiji were swept off in thousands by so comparatively mild a distemper as measles: we can therefore understand how terrible must have been the ravages of so fatal an illness as smallpox, which was then first introduced from Europe. Even at the present day it is dreaded, but at that time it was twenty times more deadly and dreadful than now. The Indians were swept off in crowds, and the islands were almost depopulated. The mortality was increased by the miserable sufferers flinging themselves into the streams and rivers to seek relief from the burning fever that consumed them. Granting that the great majority of the Indians succumbed from disease and famine, the remainder of a people deficient in stamina might easily have dwindled away under the conditions then existing. Labor was odious to them, and that in the

mines proved very fatal. The pearl fisheries also caused much mortality. These were chiefly worked by Indians from the Bahamas, who were expert divers and able to remain long under water; but so little care was taken of the men that they gradually died off, and, as the Bahama Islands had been entirely depopulated, it was impossible to supply their places.

Of course, the cruelty experienced from their conquerors was one among other causes of the disappearance of the Arrowauks, but if the Indians were so numerous, it would be contrary to experience that oppression alone would so soon have exterminated such a multitude, in islands of such considerable area and so inaccessible to invaders.

THE FOREIGN ELEMENT IN AMERICAN CIVILIZATION.

By ARTHUR HOUGHTON HYDE.

THE history of the United States, more than that of any other nation, is a history, not of wars and dynasties, but of the progress of a people. In the early days of British dependency the population of the thirteen original colonies comprised representatives of several diverse races, many of whom had sought the inhospitable shores of a new land to gain religious liberty, others to better their worldly condition, some under compulsion, yet all these heterogeneous elements became for a time amalgamated, animated with one desire and purpose—liberty, freedom from what they considered the unjust exactions of the English Government. This country occupies a remarkable position among the nations of the world; although its early citizens were principally of the so-called Anglo-Saxon race, yet there was among them a plentiful sprinkling of representatives from the Teutonic, Latin, and Celtic nations. Even in the days of its genesis it probably possessed a more heterogeneous population than any other country of the earth, and during the century and more of its development the foreign element has been an ever-increasing quantity among the inhabitants, until now we find that 14.77 per cent of the entire white population is foreign born, and 22.74 per cent more of foreign parentage. It is for these reasons a matter of some wonder that its historians have not paid more attention to the ethnic and racial composition of the population, and endeavored to ascertain what modifications these factors have produced.

Never have I found a finer appreciation of the true importance of the ethnic factor than in a recent article by Raoul de la Grasserie, in which occur passages translated as follows:

"The ethnic character has a profound influence on the choice between the two modes of government. With some peoples, individual autonomy—independence of character—is strongly traced; for example, among the Germanic nations. Each one engages only his extreme exterior in society. With nations of such temperament, family life is strongly developed; the *home* is a sacred ark. . . .

"With some other peoples—with the Latin nations in general—it is quite different; the autonomy is less refractory; they like to live in society, and prefer to discharge the functions of thinking and wishing upon others. . . . The will not being carefully cultivated, it diminishes, and the state acts for the individual.

"It is not the race alone that has influence in this matter, but many other factors—climate, soil, religion, and time; usually all these concur in giving direction." *

Nevertheless, the writer fails to reach important conclusions logically deducible from his premises, although the diverse racial composition of the nations of Europe, where it is an almost unvarying factor, can scarcely be brought into analogy with the same phenomenon in America, where it is constantly changing.

American civilization can scarcely be regarded as a native product, for it did not slowly grow up upon the soil, but was transplanted by the earlier settlers from European shores early in the seventeenth century. The progress of civilization is largely due to the evolution of thought, the passage from the less to the more complex—from the homogeneous to the heterogeneous, the advance in religion, science, art, literature, liberty, which are themselves again all interdependent upon the primal factor, the evolution of thought.

Many conditions were then favorable to a rapid advance in American civilization: the colonists were in most cases men of some education, their minds were imbued with the principles of liberty, and the early fanaticism which characterized the religious refugees gradually disappeared under the influence of the new life. In Pennsylvania, which in its conception was planned as a refuge for all persecuted for religion's sake, where the greatest freedom of mind and person was enjoyed, we discover that civilization progressed most rapidly, a progress which placed her at the head of all the other colonies until the beginning of the nineteenth century. What effect, then, we must ask, has the foreign element had upon American thought, and incidentally upon the material resources of the country. To the former question history vouches no reply, and even to the latter no satisfactory answer is afforded. It is true that many writers have attributed the rapid increase of the population to the immigra-

tion movement, and this proposition, while it has been generally accepted, must be relegated to the already long list of popular prevailing fallacies; and although this movement may have been responsible for a slightly larger aggregate increase than if the natural increase had alone prevailed, it can scarcely be considered an important factor.

It is a well-known law of population that, other things being equal, the rate of natural increase of population varies in an almost inverse ratio to its density, so that as the density of the population was increased by the addition of aliens, the rate of natural increase declined, which is demonstrable from statistics furnished by the census records of this country.

Prior to 1830 the foreign arrivals constituted far less than five per cent of the entire increase, yet it was during the period from the close of the Revolutionary War to that year that the entire rate of increase was the greatest, and we witness from that time a steadily declining rate of aggregate increase and a steadily advancing rate of increase of alien arrivals; thus in the decade ending 1840 the foreign element constituted ten per cent of the entire increase, in 1860 it had risen to thirty-two per cent, and in 1890 to forty-five per cent, and while the action of the law may be slightly disturbed by the varying fecundity of the different nationalities among the alien immigrants, yet this disturbing factor is in part equated by the larger mortality usually prevailing among children of parents belonging to those races marked by the greatest fecundity.

It is my purpose in the following pages to briefly trace the immigration movement, and outline the more important developments in the nation's progress attributable to it. The early citizens of this country were, as in every other new state, a hardy race, inured to toil, unaccustomed to luxury, with little scholarship and less wealth; but with this addition, every white man was actually as well as theoretically the peer of every other citizen. There was no dominant class; there were few servants except the slaves.

Scarcely had peace been declared when the immigration movement began again, but it was not extensive, and up to 1810 the alien arrivals in this country varied from four thousand to six thousand annually. In that year, however, unfriendly relations, followed by war with Great Britain, for a time put a stop to this movement; but in 1815, a state of amity again prevailing, it resumed with increased vigor. Among the immigrant arrivals in these early days we find a large proportion of agriculturists, mechanics, and skilled laborers; the trouble of 1798 drove many of the ablest Irishmen hither, and the immigrants were usually the more intelligent and ambitious members of the middle classes. The British journals, in 1815, com-

plain of "the ruinous drain of the most useful part of the population of the United Kingdom," and that universal panacea for all ills, social and otherwise—parliamentary action—was demanded. The skilled craftsman upon his arrival found positions of responsibility awaiting him; the native inhabitants did not have any considerable knowledge of the mechanical arts, and it therefore devolved upon the foreigner to take the position which the American was incapable of filling. The school teachers were largely recruited from the ranks of the alien; early in the century all the booksellers but two in Philadelphia were foreigners, and of the five newspapers in that city two were owned by Englishmen and two by Irishmen. With these desirable immigrants, however, began to come another class, poor and ignorant, having neither trade nor money; they became stranded in the seaboard towns, being without the means to proceed farther; some became laborers, others earned a precarious livelihood by doing a little work at intervals, but many finally became dependent upon public charity. Then it was that the delinquent classes, paupers, and petty criminals, arose and multiplied rapidly for the first time in the history of the country.

This evil might have then been almost eliminated from the population, or at least materially abated, but unfortunately the great city of Philadelphia at that time, when it most demanded prompt suppression, fostered it by well-meant but indiscriminate charity, which of course resulted in the rapid growth of a dependent and semi-criminal class. It is almost needless to point out that social evils may spread as rapidly as diseases of the flesh, and that the moral contagion is much more difficult to eradicate than the physical; and it will therefore occasion no surprise to find that pauperism and crime communicated themselves to the native element. Yet in no community exhibiting the complex organization that did this country at the beginning of the nineteenth century would an escape from this evil have been possible; the hour of its arrival might have been somewhat postponed, but the very fact of the rapid spread of the contagion is an indication of the unhealthful condition of the social fabric; of this, too, we have further evidence in the incipient rebellions which began almost immediately after the Revolution was over, and manifested a restlessness and impatience, largely on the part of the native American element, and a dissatisfaction with constituted authority.

Here a distinction is to be drawn between the development of the North and the South, and, as the latter presents few complex features and can not occupy much of the space of this article, it may as well be dealt with here. Of the original colonies, those south of the thirty-seventh parallel seem to have never attracted many aliens,

although for a time in the early part of the century Alabama appears to have been a popular focal point with emigrants both from the older States and from abroad; yet this was one of the richest sections of the country, abounding in natural resources, and would have ordinarily afforded a livelihood with much less expenditure of energy than would the territory farther to the north. Perhaps the general disinclination on the part of natives of the temperate zone to settle in warm climates may have been in slight degree responsible for this state of facts, but there can be little doubt that the institution of slavery was a more serious detriment to the advancement of the South than any other cause. There had begun to grow up there an aristocracy as exclusive and as proud as that of any state in Europe, and which, in fact, dominated the whole section; the agricultural operations were carried on principally by slaves, and the land-owners lived in a kind of feudal state, surrounded by a large body of dusky retainers; the remainder of the white population were poor and ignorant, exercised little more influence than did the negroes, and were looked down upon by both blacks and whites alike. Work was regarded as degrading and beneath the dignity of a gentleman, and strangers proposing to establish themselves there were looked upon with a jealous eye. All these circumstances were highly unfavorable to the establishment of new industries and to its industrial progress. There were no mines and manufactures, because there was no one with sufficient knowledge to conduct the operations.

We find that early in its history a certain stage of civilization was reached, for a time and in one way in advance of that of the North, due to the creation of a leisured class, but, being reached, there was no further advance, and for nearly half a century no progress was made. The war of secession and the concomitant abolition of slavery brought about in a few short years what it had taken centuries in Europe to accomplish: a hereditary servient class was raised to an equality—political and theoretical at least—with a hereditary dominant class which was by the same force rendered almost penniless. This may have proved the salvation of the South, but for a time a black pall of misery and degradation settled down upon it. There were no industries to revive, there was no all-powerful middle class; the aristocracy had been ruined, and between the two extremes there was no mean.

About the close of the first quarter of the century we discover that a servient class had also begun to be created in the North, but it was entirely distinct from that of the South; the services of its members, most of whom had sought a new world with the ulterior object of bettering their condition, were given voluntarily and for wages. A dominant class in the present condition of society appears to be neces-

sary to the higher advances in arts and material prosperity, and with the creation of a servient class which was composed principally of aliens, a dominant class inevitably arose, which may be numbered among the earliest contributions of the foreign element to American civilization.

In 1812, at the commencement of the second British war, the state found itself in a most depressed financial condition; national and individual ruin were freely predicted, an extensive westward movement began, and that great central section of the country lying between the Ohio River and the lakes, the Mississippi and the Appalachian Mountain system, then almost a *terra incognita*, commenced to receive large increments in population from among these pessimistic Easterners. What the result would have been had these gaps in the population of the New England and Middle States not been filled within a few years by aliens it is hard to discern; possibly the development of this section might have been slightly delayed, although not by any means necessarily so, as a diffusion of the then existing population would otherwise inevitably have followed, doubtless with beneficial results. But it is unnecessary to here speculate upon something which never happened.

These earlier immigrants to the country were, as we have already seen, largely of the better class of mechanics and skilled laborers. The farmers constituted about a sixth of the entire alien arrivals, and the remaining five sixths usually found occupation in the towns; in fact, the growth of the urban population is closely identified with the immigration movement. In 1790 the urban population constituted but three and a third per cent of all the inhabitants, and there were only six cities with a population in excess of eight thousand; in the decade between 1810 and 1820, when, as already noted, there was a large westward movement and a decrease in immigration by reason of the war, the percentage of urban inhabitants remained unchanged, but otherwise it has increased in an almost constant progression until the decade from 1880 to 1890, during which the rate of progression advanced considerably.

The first definite statistics which we have of the immigration movement begin with the year 1820, when we find the Irish element largely predominating over all other arrivals; it is regrettable that we can not distinguish the north Irish and the south Irish, as they may be regarded as widely variant factors. It was from among the latter that the servient class—day laborers, domestic servants, etc.—was drawn, and it was also largely from among them that the delinquent classes were recruited. In 1830 the German aliens began to constitute a considerable factor among the arriving immigrants, being in excess of those from Great Britain, but the Irish continued in the

preponderancy until 1854, when they were surpassed by the Germans. The year 1847 marks the beginning of an important epoch in the history of immigration; during this year the foreign arrivals numbered 234,968, and in 1849 the number had risen to 297,024; then it advanced with startling rapidity to 460,474 in 1854, and in the following year fell off just one half. This movement was induced by three causes: the Irish famine, commercial depression in Germany, and the discovery of gold in California. That this was in part a "boom movement," and that many of the immigrants returned to their homes nourishing disappointed hopes, can not be doubted, yet, while a large number of these arrivals formed no permanent element in the American state, they served a purpose by opening up the great region to the west of the Mississippi, a land at that time almost unknown except to a few native American pioneers; in fact, it becomes apparent that in every new and unexplored section the native Americans constituted the advance guard of civilization, leaving the foreigners to come in later, when the primeval wilderness was but a tale of the past. During this period of a little over six years there crossed the borders into this country over two and a quarter millions of persons, at a time, too, when the entire population did not exceed 23,200,000; and of these alien arrivals fully eighty per cent were from Ireland and Germany. Twice have the arrivals from Germany overbalanced those of all the English-speaking people: once in 1867 to 1868, and again in 1881 to 1885. Shortly after the middle of the century the arrivals from Ireland and those from Great Britain approached an equality, and in the year 1868 the Scandinavian influx began. In the decade between 1880 and 1890 three new elements, the Russian, Austrian, and Italian, also began to arrive in considerable numbers. Since the Revolution, the English-speaking immigrants entering this country have preponderated over all others, having reached a total of 8,016,402,* † almost half of whom were Irish; those from the United Kingdom alone have numbered 6,964,815; † the arrivals from Germany have been 5,003,490; † from Scandinavia, 1,192,131; † from Russia, 749,039; † from Austria, 821,663; † and from Italy, 818,011.† But while the movement from the latter countries is increasing, that from those first mentioned shows signs of diminution. From China over 300,000 persons have arrived, and from France, 388,000, but

* Since July 1, 1885, no record has been kept of immigrants from British North America.

† These returns are corrected to September 30, 1897. The figures include all alien passengers to December 31, 1867, and immigrants only from that time to the first-mentioned date. Prior to 1820 no records were kept of the immigrant arrivals, and my estimate can be only approximately correct.

the principal movement from that country was prior to 1860, and is perhaps attributable largely to the political unrest there prevailing in the early years of the century. The total immigration has amounted to 18,476,726,* the greater proportion of which have been males between the ages of fifteen and fifty years.

Previous to 1828, few children under the age of fifteen years arrived, but after this year there was a distinctive increase in the family as distinguished from the individual movement. The family movement has been much greater among the British than among the Irish—which people present the anomaly of the female emigration being generally equal to and in some years in excess of the male—but is most marked among the Germans and Austrians; † while, on the other hand, from Scandinavia, Switzerland, and the Mediterranean countries of Europe it is an unimportant factor. In the case of Russia, however, a family movement of some magnitude seems to have prevailed.

Great Britain, as might be expected, has furnished more skilled craftsmen, clerks, etc., than any other country. The greatest number of farmers ‡ has come from Germany, but Scandinavia has also furnished an appreciable proportion. From Ireland have come more unskilled laborers and servants than from any other country, although Germany is a close competitor. Since the middle of the century, and even more markedly since 1880, the status of the arriving body of immigrants has, altogether, vastly deteriorated. The swarms of aliens who are generally classified as “without occupation,” arriving from Italy, Poland, and Hungary, have enormously swelled this total. While it is true that the immigration statistics show a considerable number of farmers * from Russia and Italy, yet these rarely continue their original occupation upon arriving in this country; in fact, a large number of them ultimately come to constitute the refuse population of our great cities.

That the foreign element has exercised an effect observable in visible and tangible results can not be doubted; it was primarily the effect of training by foreign craftsmen that the native workers have arrived at the degree of proficiency in arts, manufactures, and all industries which now distinguish them. Many aliens have fought by land and by sea in the wars in which this country has been engaged; aliens have had command of its fleets and its armies; sev-

* See note (†) on page 393.

† Not including the Hungarians, among whom the proportion is very small.

‡ The word farmer is used synonymously with “agricultural laborer,” as employed in the reports of the Commissioner of Immigration, although as a matter of fact many of those so classed have scarcely a knowledge of the rudimentary principles of farming, and would be incapable of conducting the most ordinary agricultural operations.

* See above note.

eral of the most distinguished names in the annals of American achievement claim a foreign birthplace. But must we stop here—is this all that the foreign element has done for American civilization? If so, the debt of the United States to the stranger is not great, and immigration may with good cause have restrictions placed upon it.

Scarcely were the American colonies founded when the anti-immigration sentiment began to develop. The colonies of New England and, to a lesser degree, Virginia looked with suspicion upon aliens arriving upon their shores, and for a time almost inhibited the movement. Pennsylvania and New York, on the other hand, encouraged immigration, and their more rapid progress over the first-mentioned must be generally admitted, although other factors in their advancement entered into the consideration which space will not here admit of being dwelt upon. Again, this anti-immigration sentiment has manifested itself almost continuously since 1790, sometimes actively, sometimes almost dormant, but never entirely disappearing. We have the results in the Chinese exclusion act, in the various laws now in existence imposing restrictions upon it, in the various laws now proposed, creating an educational test. Whether these measures, actual and prospective, are good or baneful I do not purpose to discuss, but shall pass to a cursory review of racial traits.

We find on comparison that a far greater proportion of the delinquent classes are found among the inhabitants of foreign birth than among those of native ancestry, and even those born in this country of alien parents furnish a larger ratio to these classes than those of purely American parentage. Of the three great elements in the foreign population represented by the Teutonic, the Celtic, and the so-called Anglo-Saxon race, the proportionate numbers furnished to these classes by the Celtic race exhibit a remarkable predominance over either of the others, and this excessive defectiveness, we discover, also extends to the offspring of Celtic parents. The Britons and Germans show little variance from each other in their contributions to these classes, and the Scandinavians exhibit a slightly higher percentage in such contributions over the two last mentioned. The other nationalities represented in the population can scarcely with fairness be drawn into the comparison on account of the recent date at which they have begun to arrive in any considerable numbers; nevertheless, the records of our criminal courts contain the names of many Italians, and already the Hungarians and Poles, the most miserable and degraded representatives of the Caucasian race who cross our borders, are largely numbered among the dependent classes. We have also to notice in these classes a much greater

proportion of females to males among the foreign than among the native element. Havelock Ellis, too, has observed that the criminal instinct manifests itself with much greater frequency in the Irish woman in Great Britain than when at home, and suggests that it is due to a removal of domestic influence; his theory may perhaps be accepted as a partial explanation of a like phenomenon in this country. It is a well-recognized sociological fact that crime is much more prevalent where large aggregations of men are herded together than in the country districts, and this also must be considered in correlation with the further fact already noted that the alien population is much more largely urban than the native.

Mr. S. G. Fisher, in his work, *The Making of Pennsylvania*, says: "As shown by statistics, the Germans in America, in proportion to their numbers, have produced fewer remarkable and prominent men than any other division of the people. The race itself is not deficient, but when it isolates itself in an American community it is cut off from the best development of that community, and also from its old associates in Europe, and inevitably deteriorates." Elsewhere he remarks that they are difficult of assimilation. That these statements are in part well founded may not be questioned. And with the increasing homogeneity of a people a deterioration, or at least a check to advancement, must inevitably follow, as I have already pointed out in the case of the South. But we have rid ourselves of the notion that great men make history; great men may hasten or retard a movement, but it is the larger, invincible force of popular will which to-day moves the political and social world; which has always moved it, and always will move it. It took the peasantry of Europe ten centuries to shake off the thrall of serfdom. In the eighth century no man, however great, could have freed the serfs; in the fourteenth, no man, however great, could have restrained the flow of liberalizing sentiment. The mills of God may grind slowly, and also exceedingly small; but "with patience he stands waiting, with exactness grinds he all."

The Germans form one of the best elements in the American community; clannish they may be, given to herding together, and yet, although frequently on the surface Germans even to the second and third generation, retaining forms and ceremonials of the fatherland, they are, in fact, readily assimilable. They become assimilated through American influence, newspapers, literature, society, business, and in the second generation through American birth and education, and become true Americans at heart. Their love for the fatherland has been transferred in even greater intensity to their foster land.

I have already noted the fact that the largest proportion of our

delinquent classes is derived from the Celtic element. The Irishman is practically a man without a country; he owes an ill-rendered fealty to the British crown until he leaves his native island and swears allegiance to the American Government, but the oath rests lightly upon him; all the patriotism which he possesses is centered in that ill-starred rebellious dependency of Great Britain on her west. While on the surface more easily assimilable than the Teuton because he speaks the language of his adopted country, he is first an Irishman,* then an American, and such only so far as it is an America of the green flag. A distinction must, however, as already observed, be drawn between the natives of the north and those of the south of Ireland—the Saxon Ulsterites and the Celts. From the latter is derived the large proportion of our delinquent classes; the Molly Maguires were Irishmen, and it is the Irish who have had the largest share in the corruption of our governmental institutions. The Ulsterites, on the contrary, being principally of Scotch and English stock, partake of the characteristics which mark the British alien in America.

It is unfortunate that a few unassimilable Englishmen, who never had any intention of becoming assimilated, and who are at all times aggressively British, should have conveyed the impression that the British immigrant does not make a good citizen. On the contrary, there are to-day over a million people in all parts of this country born in Britain, honest, frugal, hard-working, and industrious, fulfilling by reason of their close affiliations with the people of the United States all the requirements of the best American citizen.

There are, as we know, other races, Latin and Slavonic, wretched and ignorant, the superlatively low, the refuse of civilization, unaccustomed to freedom, unacquainted with equality; they have the privilege after a brief period of residence of exercising all the rights of native-born citizens, but only value the franchise at the pecuniary worth, or vote blindly under the direction of some corrupt demagogue. Coming from a condition bordering upon serfdom, it will be found that they are almost unassimilable, in the first generations at least; incapable of distinguishing liberty from anarchy, these people—principally Russians, Poles, Hungarians, and Italians—are landed on these shores in numbers probably in excess of fifty thousand a year.

The anarchist and ultra-socialist parties do not, as is commonly supposed, derive their chief support from the Teutonic element; their ranks are rather recruited from among these members of the Semitic

* The great pilgrimage which will be made to Ireland during the coming summer by thousands of American citizens of Celtic extraction to celebrate the centenary of 1798 furnishes us with one demonstration of this proposition.

and Slavonic races. At the late presidential election the socialist vote in New York city was 7,326, an increase of about fourteen hundred over that polled in 1892. Doubtless, as the socialists claim, the increase would have been much more considerable had not the silver question for the time taken precedence of all other issues, although the socialist propaganda publicly declared against free silver. In 1895 the party polled 10,993 votes. The significant feature of the situation, however, is the marked increase in the party's vote in the ninth congressional district, situated on the east side of the city, south of Stanton Street. Here more than half the socialist vote was polled. It is here that the socialists expect to elect, within a few years, an assemblyman to represent them at Albany; it is from this district that they hope ultimately to send a congressman to Washington. In the twelfth assembly district, constituting a part of this congressional district, the result of the recent election was tabulated as follows: Tammany (Democrat), 2,590; Republican, 2,257; Socialist, 1,284. It is in this section of the city that the socialists are centralizing, that the most active party leaders are colonizing. Such imperfect statistics as are available reveal the fact that the Hungarian, Polish, and Russian population stands in the ratio of 5 : 1 to that of all other nationalities. Many of the first three named peoples are not yet voters, but each year the naturalization mill turns them out by thousands as free electors, after they have solemnly sworn to uphold the Constitution of the United States. Yet the socialist ideals are entirely at variance with the true theory of American government as conceived by the early makers of the American state. The question, then, confronting us is whether the process of assimilation or the growth of socialism will be the most rapid.

I had thought to find every advance made in civilization distinctively associated with a certain race or races, and while the characteristics of many races have become implanted in and integral parts of the national civilization, yet I am obliged to admit after deep reflection that such advances are due in greatest part not to the individual or the race, but to the entire foreign element. When the number of immigrants was comparatively small they became quickly amalgamated with the native population, but as the numbers increased, progress in this direction was naturally slower, yet in no other country has the process been carried on so quickly and thoroughly in proportion to the amount of material to be acted upon as in the United States. As the national spirit acts upon the foreign element, so the foreign element reacts upon American civilization: there results one heterogeneous whole, and this increased heterogeneity arising from an admixture of nationalities is, as already intimated, the primal cause of American progress. It is a little re-

markable, however, that the application of this principle should have almost escaped the attention of every writer upon this subject, or been lightly passed over by them. Mr. Giddings, whose work on sociology is the only one based upon American inductions, scarcely notices it; and his associate, Mr. Mayo-Smith, while he has examined the subject of immigration extensively, appears to have entirely overlooked the real value of the foreign element.

It is in the purely American commonwealths that civilization is to-day the lowest; the coast States, from Virginia to Louisiana, have a foreign population of only 1.61 per cent,* yet it is here that the illiteracy is greatest, and that there is least commercial and industrial progress. It is this section, too, which produces the clay-eater and "cracker," native-born white American citizens, yet so degraded that continental Europe can scarcely show a lower type of man. It was the solid American vote of the South which at the late election was cast for Bryanism, repudiation, social upheaval, and all else that that name implies. North Carolina, which does not contain within its borders a single town having a population in excess of twenty-five thousand persons, has the highest degree of illiteracy among its white inhabitants, and the smallest proportion of foreign population of any State in the Union. Lest it should be imagined, however, that it is the alien which has the effect of reducing the aggregate illiteracy in the Northern and Western States, it may be remarked that the percentage of illiteracy is almost invariably higher among the foreign than among the native element.

It has already been pointed out that it was the civil war and slavery which in part caused a regression in Southern civilization of at least a quarter of a century, but it will be found that this misfortune was closely associated with the homogeneousness of the people and the absence of a foreign element. In 1884 the Southern Immigration Society met at Nashville. In the report of its proceedings appeared this significant statement: "*The immigration movement is to be the great revolutionary movement in the political economy of the South.*" The society has probably ceased to exist, but these words have lived and borne fruit. There is to-day a movement toward the South, partially from abroad, more from the North, but introducing at least a new element—not very great, perhaps, yet still perceptible, not only in a changing population, but also in results, in a revival of industry, in a decrease of illiteracy.

Louisiana stands alone; already a well-established colony possessed of a high degree of civilization borrowed from France when acquired by the United States, there exist so many different factors

* United States census, 1890.

in her development scarcely relevant to this article that I may not examine them here. The agricultural depression and other causes which have given rise to militant populism in the West have received their full share of attention from numerous writers, and it will therefore suffice to say that they do not appear to be in any way associated with the foreign element.

I have only been able in this article to give a rough outline of the effects which the alien has wrought on the civilization of the United States; much of consequence has been left unsaid, many important stages of development omitted. I can at most claim to have drawn attention to some important facts hitherto overlooked, and to have pointed out a direction which future investigation may follow in an endeavor to solve the great immigration problem.

THE CAINGUÁ OF PARAGUAY.

By DR. MACHON.

THE several tribes of Caingúa Indians are scattered through the immense forest region that extends from the Ygatini to the Monday, and from the central Cordillera of Paraguay to the banks of the upper Paraná. In the midst of those grand *yerbales* (forests containing the *maté*, or Paraguay tea plant), these children of the forest dispute for their hunting grounds with the "Tupi," or refugee braves from Brazilian hostility. Like the latter, they belong to the Guarani-Brazilian race, and speak the Guarani language. They form numerous groups of population, divided off into small tribes that live isolated from one another, and assemble only occasionally to resist an invader or undertake some expedition. Like the ancient Guaranis, their native docility is so great that we can easily comprehend how the Jesuit missionaries gained an ascendancy over them. There is no doubt in my mind that the Caingúa, whom I had an opportunity of studying, were subjected to that influence about two hundred years ago, and have since gradually fallen back, after the decline and ruin of the missions, into their primitive savagery. Of this bare contact with civilization they still retain their belief in a Supreme Being living in the sky, and know something of St. Thomas. But, aside from these rudimentary notions, their religion is null and destitute of every kind of outer worship. A few of the old men recollect some of the Latin hymns with which their ancestors rocked them to sleep, and they have preserved a hierarchical organization from the past.

Every *tapui* or village has its cacique, who is dependent in time

of war on a supreme chief, and in time of war, too, has under his orders a series of officers bearing the titles of *teniente* (or lieutenant), *sarjente* (sergeant), and *cabogrades* (corporal). But in time of peace these grades imply no authority. The whites inspire a respectful fear in them, and while in their relations with us—which they rather avoid having—they behave honestly, the honesty is the result of dread of the white man's presence.

Recognizing the value of the protection of the white man, they would more frequently have recourse to him for defense against the Tupi, but that they would have to pay for that protection by the servitude into which they would fall. Now they avoid the white man too, and it is only the desire of exchanging labor for objects of prime necessity that prompts them to give their services in the collection of *yerba* or *maté*, and the getting out of building timber.

Their *tapuis* or villages are situated in the depth of the forest in a clearing, or on its edge near a stream. When they are a short distance from a navigable river, the people make a path that leads to the place on the shore where the canoe used in fishing is moored. These villages generally contain only a very limited number of families, each of which has its own house. At a shorter or longer distance away, in an artificial clearing, are small plantations of manioc, yams, and maize, which are reached by paths cut through the thicket.

The house of the Caingúa is smaller, but better built, than the Paraguayan ranch. The frame of roughly hewn trunks of trees supports a thatched roof and bamboo walls covered with a layer of mud mixed with plant stalks. These houses have no windows; the low and narrow roof is usually furnished with a large palm leaf as a *portière*. The floor of the cabin is made of beaten earth, and the furnishings are simple and rude. A single piece of furniture that is never wanting is the *tatou*, a kind of seat made out of a rudely shaped piece of wood which in form resembles the animal (the armadillo) after which it is named.

The Caingúa have no beds, but usually sleep on the ground. The few hammocks they have, formed of a bundle of leathern strips bound together by transverse knots, are considered objects of luxury reserved for the men. Antonio, a young Indian whose guest we were for about five days, found it quite natural to rest in the hammock from fancied fatigues, while his poor little wife, hardly a dozen years old, lay upon the bare ground at a nearly freezing temperature, although she was in a delicate condition. Some bamboo bundles, set a short distance above the ground, were not beds, like those we saw among the Toba Indians in the Chaco, but supports on which provisions were piled in anticipation of the heavy rains. Large

calabashes for carrying water were hung on the walls of the cabin, as were also the spare arrows, the crop of wild cotton, and all the thousand nothings which these big children have the craze for collecting.

The fire is built out of doors when the weather permits it; but when it is raining, or is cold, it occupies the place of honor in the cabin, and men and animals sit around the blaze without seeming to be troubled by the smoky atmosphere. Fire is obtained by means of two sticks of dry wood, one of which, held tight between the feet, receives the end of the other. The second stick is revolved between the hands with a rapidity on the degree of which the production of the desired spark depends. The water is boiled on the fire for the *maté*, which is taken without sugar by means of a reed pipe; and the game is roasted there. If the weather is rainy, and laziness does not overcome the disposition to work, as it generally does, the man, smoking his pipe, weaves baskets and sieves for household use, and his wife oversees the preparations for the meal, or spins cotton, from which she makes a very durable cloth.

The men are generally well built and of medium stature; their limbs, especially in youth, are well developed—a result of their constant handling of large bows and their fondness for long walks. The color of their skin is a fine bronze, with variations that are largely dependent on the relative cleanliness of different individuals. With the bachelors, the ebony hair is worn flat, and covers the nape, while the married men wear it short and curled. Generally they wear no ornaments on the hair; but if there is occasion for it, the Caingúa bind their locks with a colored kerchief and perhaps put in a few feathers. Some travelers have spoken of tribes marked by their lighter tint and blond hair; so far as we have been able to find, there exist a few families in which albinism is hereditary, and this is probably what gave origin to the legend. Their face is full and round, the nose somewhat flattened, and the nostrils open, made so by the people's enlarging them with their fingers. The middle part of the lower lip is turned outward and pierced. The eyes, oblique, and always looking outward, give the physiognomy a very mild, even feminine, character.

The masculine dress consists of drawers terminating in fringes and bound in front and behind by a belt of braided hair; and for ornament a double collar is worn of the hard seeds of certain vegetable species mingled with variously colored bits of glass and vertebræ of small reptiles colored brown with *quebracho*. Under this collar a little pocket of raw hide holds the chewing tobacco. All, young and old, men and women, wear the *barbote*, or a hole in the lower lip, by means of which they can perfectly imi-

tate the various cries of birds. The flesh is bored for this at about four years of age with a sharpened bamboo stick; then, to prevent cicatrization, the orifice is kept open by drawing through it occasionally a leaf of dry grass. The higher caciques, we are told, alone have the right to wear in it, as a mark of their dignity, a plug of hardened yellow and transparent resin in the shape of a T.

The women are small in stature; their forms are slighter than those of the men. Their hands are very fine, and their hair is seldom combed. Their dress consists of a sort of small skirt folded around the form and descending to above the knees. Like the men, they go out barefooted, with the chest covered with several strings of beads, to which they sometimes attach a few bones for amulets. They also wear bracelets of hair, and eardrops composed of a string of red and white pearls, ending in a small triangle of nacre from one of the shells of the country. When young, they are quite attractive, although disfigured by the painting with which they mark their faces, consisting of a series of horizontal and vertical lines traced with charcoal dust, or a layer of beeswax which they put upon their skin. To be fresh, it has to be renewed every day. The young men also employ it to make themselves pleasing to their sweethearts, but married men put on no colors.

The children wear a miniature breeches or small petticoat; only the babies are naked. The feeling of modesty is so well developed among these Indians that it was a hard task to get one of these children's costumes, and still harder for the young fellow to exchange his breeches for the handkerchief we gave him.

The life of the Caingúa is divided between hunting and fishing. His arms, which he is never without, consist of a bow and a bundle of four arrows. The bow is about six feet long, and the arrows are nearly five feet. They are of guaiacum wood and the strings are of *caraguáto* (a vegetable fiber). In exchange for working in the *yerbales*, the Caingúa obtains from the whites machetes, knives, cooking utensils, and farming implements.

His fishing canoe is hollowed very patiently in a cedar log. The hooks come from abroad, and the line is made of fibers of the *caraguáto*, or some other textile plant. They shoot their arrows aiming them directly at the object or firing them first into the air; for this purpose they throw the bust back, an exercise which develops the muscular system in a remarkable way. They never lay themselves on the back to shoot, as most of the Brazilian Indians do. Their skill is very great, but their game bags are often very scantily filled. The game is generally composed of various species of birds, which they stun by means of an arrow ending in a wooden knob. Two other arrows, ending in points barbed in various ways, and of

hard wood, are styled war-arrows, while a fourth kind, the only one having a metal point, is reserved for the tapir.

In hunting this animal—an important feature in the life of the young Caingúa—they display all their knowledge and all their skill. Perched on high trees or hidden in the underwood, they wait for the animal to pass, and wound it mortally with their steel-pointed arrows. A merciless pursuit then begins, and does not end till the timid, harassed pachyderm dies of exhaustion. The chase of the jaguar is more perilous, and sometimes ends in a fight at close quarters.

The Caingúa also set traps, and sometimes travel for hours in the underbrush to visit them, with their arms in their hands and their provisions in their *bocco*, or basket made of *caraguáto* fibers, which they carry slung over their shoulders. When game is scarce, or indolence keeps them in their lodges, they hunt the rats and field mice that swarm in their winter's provisions; the victims, slain with sticks, are immediately put upon the fire just as they are, and devoured on the spot.

Work in the house and the fields devolves upon the women. They carry their burdens on their backs in a pretty basket. They make blackish earthen vessels out of a clay which they go a considerable distance to get. Another finer earth is the material of a pipe in which the husband smokes the leaves of a wild tobacco. Contrary to the Paraguayans, the women do not smoke. In one family we saw a horn spoon like that of the Lengua Indians of the Chaco. Aside from the dogs and the hens which only the rich possess, the Caingúa have no domestic animals. The parrots which are seen quite numerous in the villages, tied by one foot to a light clog, are there only as a reserve for the kitchen.

The only formality which the swain has to go through to get the hand of his promised one is to kill a tapir, an act by which he proves that he will be capable of supporting his prospective family. The death of a tapir under such conditions is quite an event; the whole tribe assembles at the carcass, and a scene of gluttony begins that does not cease till nothing is left but the skin and bones of the "great beast." That is the only ceremony of marriage. The Caingúa is usually monogamous, but polygamy is allowed. Marriages of relatives are carefully avoided. After confinement, the young mother has a rest of a few days before resuming her servile task. She carries the newborn infant in a scarf, or sort of little hammock slung over her shoulders. She does not think of weaning it for a year and a half or two years, while the child has already been exercised in arms with miniature bows. Ideas of cleanliness seem foreign to the women as well as to the men, and it is a lucky chance that will induce them to comb their magnificent heads of hair.

Like the big children they are, they burst into laughter at nothings, and laugh immoderately at whatever is new to them. Never shall I forget the hilarity and curiosity which possessed our friends of Puerto Venezia as they watched me one day changing my clothing. The braves, squatting on their toes or leaning against the wall, pointed at each article of dress, and were greatly amused at the specimens of the refinement of our civilization of which they evidently could not understand the bearing.

Their musical feeling is still in infancy, and their musical instruments are extremely primitive. They play the simplest kinds of airs on a bamboo flute or a guitar rudely imitated from the Paraguayans, and dance or rather jump to them with their feet held together or pushed one before the other, holding the lobes of their ears between the thumb and forefinger. Sometimes the dancers wear also a belt composed of a series of hoofs of animals, which, clattering against one another, make a noise like that of a little bell. They hold a rattle in their hands, shaking it rapidly, which consists of a kind of fiddle-case rudely cut with a knife, containing bits of glass.

Their feeling of jealousy goes to the extreme, and dominates all other feelings. It is the direct or indirect cause of all the crimes and all the personal and tribal quarrels. The stranger, whom they nevertheless fear, may even sometimes run the danger of his life if he betrays too tender sentiments toward one of the damsels of the woods. In the first village we visited, the mere fact of our stopping a moment to look at the girls in order to study the arrangement of the designs with which they were decorated aroused the susceptibilities of their lawful lovers, and prevented our getting several things we wanted. Further, a young man who had probably not yet succeeded in killing his tapir, turned the bare blade of his machete nervously in his hand at seeing my companion trying the weight of his intended's eardrops before offering to buy them.

Notwithstanding their entire want of religion, the Caingua have a vague idea of a future life; for after the interment of a deceased relative they deposit on the new grave the arms of the departed and provisions for the journey which they evidently suppose to be possible. Their innate indolence, which only the Jesuit fathers were able to contend with successfully, and their indifference are likely to keep them for a long time backward in civilization.—*Translated for the Popular Science Monthly from the Bulletin de la Société Neuchâteloise de Géographie.*

SKETCH OF FRANCIS LIEBER.

BY DR. LEWIS R. HARLEY.

FRANCIS LIEBER fled to our shores a political exile, but he afterward became one of the greatest publicists of the world, and shed glory on American scholarship by expounding the principles of liberty. He accomplished in two of our colleges the work on which his fame will rest. Although he attained his scientific maturity in America, he was born in Berlin, and received his scientific training in the schools of his native land and in his intercourse with some of her most noted scholars. Lieber was born March 10, 1800, and his youth was passed during a time of intense political strife. He was the tenth child of Frederick William Lieber, an ironmonger, whose family consisted of nine sons and three daughters. From his earliest years his mind was impressed with the memories of warfare, and his father delighted to explain to him the engravings on the walls of the sitting room representing some honorable actions of his great king. His mother was one of those noble, patriotic German women who threw their gold wedding rings into the public treasury, and received rings of iron in their places, bearing the imperial signet and the words "We gave gold for iron." Lieber was but six years of age when the Prussian army was annihilated at Jena, and the country lay prostrate at the feet of Napoleon.

Lieber's first desire was to become a botanist. To this end he entered the Botanic Garden near Berlin, but he remained there only a short time on account of the ill treatment that he received from the director of the garden. The guiding principle of his school life came from Dr. Jahn, who settled in Berlin in 1809 to establish a place for physical exercise. Lieber became one of his pupils as early as 1811. Dr. Jahn realized the fact that Germany needed to be brought into a proper state of enthusiasm before it would be able to resist the French, and while he trained the young men for the battlefield he took every opportunity to appeal to their national spirit. He urged the necessity of German unity, and his hatred of France was so intense that he expurgated from the language of his school all words of French origin. Hence, he chose the word "*turnen*" as the German name for his gymnastic exercises. This system of education was the flowering of the seed that had been dropped by the French philosopher in "*Émile*," a book which brought forward a new problem in the education of the young in the eighteenth century. "*Émile*" was everywhere read, and aroused the greatest enthusiasm. The teachers sought to aid the movement in various ways, but Dr. Jahn made the best statement of the advantages of physical training, and

he gave this training a permanent place in the German system of education. His personal influence was great, and the desire of his life seemed to be to establish German unity.

Lieber remained under the instruction of Dr. Jahn until the age of fifteen years, when his school career was interrupted by the trumpet tones of war, calling the youth to the defense of their country. When Napoleon escaped from Elba schoolboys were welcomed in the Prussian army, and Lieber served as a volunteer in the Waterloo campaign. He received two wounds at Waterloo, and after recovering in the hospital at Aix-la-Chapelle he returned to his home in Berlin. He at once resumed his studies under the guidance of Dr. Jahn. In 1819 the schools for physical exercise in Prussia were closed. The same year Dr. Jahn and Lieber were arrested as enemies of the state. Upon his discharge without a trial, Lieber was refused permission to study in the Prussian universities, but was finally admitted to Jena, where in 1820 he took his degree. Being under the constant guard of the police, he decided to leave his native country, and, as the Greek Revolution had just broken out, he made his way to Greece and took part in the struggle. He became disgusted at the miserable condition of things there, and, returning from Greece, he spent some time in Rome with Niebuhr, the Prussian minister. He then proceeded to his native land, but was again placed under arrest for entertaining liberal sentiments. On his release he decided to make his home in America, and in 1827 he arrived in this country.

Lieber was recommended by Dr. Jahn as a suitable person to introduce the Prussian system of physical culture into the Tremont Gymnasium in Boston. Here he taught scientifically Prussian gymnastics; and he was one of the first exponents in America of the physical basis of education. The liberality of his views on education is well illustrated in his plan for the organization of Girard College, which attracted widespread attention. It reveals the fact that he had a wonderful grasp of pedagogic questions, and but few recent writers have made any advance beyond his liberal ideas. At that time there were no polytechnic schools in America, and Lieber's plan included the various branches of polytechnic instruction, as well as provision for the education of teachers. In commenting on the plan, Edward Livingston wrote from Paris in 1834: "You have written three lines which ought forever to be impressed on the minds of all teachers, whether of science, politics, or religion. I know of no truth more happily expressed than that 'there is a religion under all the variety of sects; there is a patriotism under all the variety of parties; there is a love of knowledge and a true science under all the variety of theories.'" As early as 1858 Lieber strongly urged the establishment of a real university in this country, as a cultural means

of promoting a more generous nationality. This was twenty-five years before the university ideal was reached in America. His conception of a university included all that our most venerable institutions have yet realized.

Lieber struggled for eight years before he found any permanent employment. In 1828 he began the work of editing the *Encyclopædia Americana*, and in his project he was warmly supported by Edward Everett, George Bancroft, and Judge Story. He yearned for the time when he might be able to write upon subjects that had long occupied his mind. In 1835 his hopes were realized by his appointment to the professorship of history and political economy in South Carolina College. In his contact with Niebuhr at Rome he had acquired a taste for historical studies, and he became the first great teacher in this country of history and politics as co-ordinated subjects.

It was Lieber's lot to encounter many obstacles in his career. Although as a boy his soul longed for liberty, he found even in America a part of the human race in bondage, and this earnest advocate of freedom was compelled to make his home in the very midst of the slave power. Lieber did not desire to go to the South, but after a struggle of eight years in the North he felt compelled to accept the position in order to provide for his family. It also afforded him leisure time to write his *Political Ethics*, *Legal and Political Hermeneutics*, and *Civil Liberty and Self-Government*, the three great works upon which his fame will chiefly rest. In 1856 he was a candidate for the presidency of the college, and, failing to secure this position, he resigned his professorship. The next year, he was called to Columbia College, New York city. Dr. Herbert B. Adams states that the call of Lieber to Columbia College marks the first recognition by a Northern college of history and politics as properly co-ordinated subjects. Lieber spent nearly forty years as a teacher of this most vital branch to the youth of the republic.

Before tracing out the leading theories of Lieber's works, it may be well to refer to the political thought of his day. His youth was spent in a period when in his own country two opposing schools of law and political science existed. The historical school based its method upon the course of outward events and their evolution, while the philosophical school began with the knowledge of the human mind, and from this starting point considered the revelation of the spirit of man in history. Dr. Bluntschli says that only a few philosophers have had the genius to unite the two methods. Lieber rose above the conflict of the two schools and became one of the first representatives of their alliance. In writing his great works he had to venture upon an untrodden path, and, in his *Political*

Ethics, also a dangerous one, because in exploring a new field he had to touch some of the most vital and delicate points. His life in the South, although uncongenial to him, was a period of rich production, and he became the author of the first great original treatise on political science in America. He had long occupied himself with the thought of writing on political ethics. He felt that the many subjects which have a strong influence on politics, and yet do not belong to political or legal science, should be treated soundly and truthfully. These subjects included the ethical nature of man, public opinion, parties, factions, opposition, love of truth, perseverance, the duty of representatives, judges, advocates, officeholders, and the pardoning power. The keynote of the Political Ethics is, "No right without its duties, no duty without its rights." The work called forth the warmest admiration of jurists, statesmen, and historians.

Lieber made another valuable contribution to political science in *The Legal and Political Hermeneutics*, published in 1839. One of the first articles which he read after landing in New York was in a paper opposed to the administration of President Adams. The writer founded his objections on the construction of the Constitution. The subject was new to Lieber, as political construction of this kind is peculiar to America, where the idea of a written constitution was first realized on a large scale. His attention was attracted by the novelty, and when he began his work on Political Ethics he was led to reflect more deeply on constitutional construction. The value of the work is stated in *The Nation* as follows: "Many of the topics discussed were at this time new, doubtful, and difficult, and Lieber lived to find conclusions which he had arrived at and was the first to express thirty years ago, referred to by writers of the present day as familiar political truths, without, perhaps, any conception on the part of the writers of the source whence they were derived." Lieber's best known work and greatest contribution to political science is his *Civil Liberty and Self-Government*, published in 1853. It was written during the vicissitudes of the French Government, and can not be read with profit without taking into view the events of 1848 and the empire of Napoleon III, for through the book there are drawn frequent contrasts between Anglican and Gallican liberty. *The Civil Liberty and Self-Government* at once attracted the attention of scholars. In 1854 Woolsey put the book into the hands of his pupils in Yale College. Professor Creasy, of England, author of the *Rise and Progress of the British Constitution*, said: "Dr. Lieber is the first who has pointed out the all-important principle of English and American liberty, that every officer remains individually responsible for what he does, no matter whether he acts under the order of his superiors or not—a principle wholly unknown in

other countries." The work was translated into German by Mittermaier, and found a warm welcome in Europe. Lieber was interested all through his life in the subject of penal law. When De Beaumont and De Tocqueville published their report on American prisons, they requested him to translate it into English, and he did so in 1833, adding copious notes, for which he received the thanks of some of our leading jurists. The King of Prussia desired to appoint him inspector general of prisons, with the permission to lecture on penology in the university.

In his later years Lieber's attention was especially directed to the subject of international law. The following words of the late Dr. Bluntschli tell of his great activity in this direction: "Lieber had great influence, I may add, in founding the *Institut de Droit International*, which was started in Ghent in 1873, and forms a permanent alliance of leading international jurists from all civilized nations, for the purpose of working harmoniously together, and thus serving as an organ for the legal consciousness of the civilized world. Lieber was the first to propose and to encourage the idea of professional jurists of all nations thus coming together for consultation, and seeking to establish a common understanding. From this impulse proceeded Rolin-Jacquemyn's circular letter, drawn up in Ghent, calling together a number of men, eminent for their learning. This latter proposal to found a permanent academy of international law met with general acceptance, but this was merely a further development of the original idea of Lieber, which was at the bottom of the whole scheme. His notion was now approved and the efficiency of the association was thus assured for the future."

Lieber's contributions to military law form the greatest work of his later years. At the instance of President Lincoln he prepared Instructions for the Government of Armies of the United States in the Field, which being approved by a board of officers and by the President, were published in 1863, as General Orders, No. 100. This work, the first codification of International Articles of War, forms a permanent addition to military law. The adoption of the code brought Lieber into close relations with the War Department at Washington, and he became its adviser in all matters relating to it. The codification was received with great favor abroad. It suggested to Dr. Bluntschli the idea of codifying the laws of war and the law of nations. His letter to Lieber is printed as a preface to the International Code; and he valued the instructions for the armies so highly that he had them published in full as an appendix to it. In 1863, at the request of General Halleck, Lieber prepared an essay on Guerrilla Parties which was received so favorably by the Government that an attempt was made to have a chair on the law and

usages of war established at West Point, and to secure the appointment for Lieber. This was never accomplished, but at the close of the war he was appointed to classify the Confederate archives in the office of the War Department.

Although Lieber was so firm a Union man, we may behold in him the symbol of civil war. His eldest son, Oscar, laid down his life for the cause of secession. His other two sons held commissions in the Union army: Norman, who became a lieutenant, and is now Judge Advocate General, and Hamilton, who lost an arm at Fort Donelson. Although Lieber took a deep interest in all public measures and followed closely the current of political thought, his mind was not adapted to take a practical, everyday part in current politics. His heart was bound up in the welfare of his country, and he could not descend to the level of the partisan. In a letter to me, Hon. A. D. White thus speaks of Lieber: "As regards taking a practical, everyday part in politics, I never thought him of the build for that. In fact, I once saw a curious exhibition of his inability to take such part. He had been elected a delegate to a State Republican Convention, and came up to Syracuse, where I then was, to attend it. As he was my guest, I suggested to him, when the time arrived for calling the convention to order, that we should go to the hall where it was held, but he was engaged in very earnest political talk with me, and put off going, probably with the idea that not much would be done until his arrival. We reached the hall about an hour late, found it in all the noise and uproar which generally attends the sessions of such bodies, and, as we listened to a roll call, found that another delegate had claimed his seat and had been admitted. He heard the name of his opponent called and responded to, said not a word, listened a little longer, then proposed that we should take a walk, and he never went near the convention again."

Lieber died October 2, 1872. One who best knew him declared that by his death the whole world sustained an irreparable loss. The influence of his profound works upon the public mind has been great. It has been charged against him that he was a *doctrinaire*, but even if this were so, it would be no reproach. While strongly grounded in the best thoughts of the best thinkers on political subjects, he was as independent in his thinking as any wise man is likely to be. However restricted may have been his popular influence as an author, his opinions and writings have been valued by the foremost thinkers of the age in every land of well-ordered liberty, and his works have been a mine of wealth to thousands who never acknowledged it. "No right without its duties, no duty without its rights," was Lieber's favorite motto, and his life and writings were molded by this principle.

Correspondence.

A CURIOUS OPTICAL PHENOMENON.

Editor Popular Science Monthly :

SIR: To one interested in observing the action of light under unusual circumstances, a very pretty display of colors can be seen in the amalgam room of the Ojo de Agua Silver Mill at San Luis de la Paz, Guanajuato, Mexico.

This room is twelve feet wide by twenty long, with whitewashed walls. The outside wall faces the northeast and is pierced by two large windows, covered with heavy wire gratings and coarse white muslin. Opposite these windows and against the southeast wall are large iron kettles set two feet above the floor in solid cement. Above these in wooden racks are hung heavy canvas sacks two feet long, to receive and strain the liquid amalgam as it comes from the settlers. This amalgam runs into the sacks, and the excess of quicksilver percolates through the coarse canvas and falls in a shower into the kettles below.

To one standing in front of this shower will appear some of the colors of the spectrum. A transverse section of this cylinder, representing the body of falling metallic particles, would have a diameter of from five and a half to nine inches, according to the rapidity of the discharge of amalgam into the top of the sack. The slower the discharge, the smaller the sectional area and the larger the individual drops, and *vice versa*.

The colors are repeated six times in the width of the stream, three times on each side of the center line or axis. This is observed at a point halfway between the surface of the "quick" in the kettles and the flow of particles from the sides of the sacks, the colors forming a line coincident with the horizontal plane. Of course, this changes slightly with the position of the observer, in accordance with the law of incidence and reflection.

The refractive action is toward the outside, as the violet appears at the outer edge. This (the violet) is fairly strong, the indigo fainter, and the blue *nil*. Under the most favorable circumstances only can the green

be detected. The yellow is about as strong as indigo, the orange of the same value as the violet, and the red most pronounced of all.

The red of each outer spectrum borders on the violet of the next inner on each side of the center, and this is repeated in the second pair where they connect with the inner or last pair. The third or inner is so faint that only the violet is visible, and that but faintly. There seems to be a gradual decrease of intensity toward the center, which is not apparent from the fact of the stronger end of each spectrum being inside; that is, the stronger end (red) of the first or strongest spectrum coming against the weaker end (violet) of the second or weaker spectrum, etc.

The greater the volume the smaller the individual particles and the stronger the colors, and *vice versa*. Late in the afternoon the sun shines on the windows, but does not occasion an increase in the value of the colors, except when some opaque object is interposed. In fact, it is always best to stand facing the "quick" and between it and the window opposite. Direct sunlight never enters the room, the windows being covered with coarse white muslin as above stated. Artificial light produces the same effect as sunlight.

The condition of the "quick" is as follows: While in the receiving kettles it is kept under a saturated solution of caustic soda to cut any grease which it may collect in passing through the pans and settlers. It contains a trace of zinc and possibly of silver. If lead, copper, or iron in the form of amalgams are present, they are in such very small proportion that it is impossible to estimate them.

It may be that in falling there is formed a film of varying thickness of zinc oxide on the surface of each globule which would have a decomposing action on the light reflecting from the surface of the globule on which it would form a coating. This I merely advance as a hypothesis.

HENRY M. STANLEY.

MEXICO, D. F., November 1, 1897.

Editor's Table.

EDUCATION IN BONDS.

THE warfare of science with theology has been amply and impressively related by such writers as

Buckle, Draper, and President Andrew White; and many have supposed that science, having accomplished this warfare and come out

victorious, had no other foe to fear. There are not wanting signs, however, that complete confidence on this point may be somewhat premature. Another enemy has appeared in the field, less severe in aspect than the old theology, but also less disinterested, less sincere, and, strange though it may seem to say so, less open to argument. That enemy is party politics, and the science it especially attacks is the highest science of all—the science of society in its various branches.

The very essence of scientific teaching lies in its freedom. Teaching that is not free can only usurp the name of science. If the word means anything, it means the movement of the human mind toward truth, toward a true comprehension of things. The world and life furnish facts; it is for science to observe, examine, tabulate, co ordinate those facts, and extract from them their widest and deepest meaning. Science does this in the interest of mankind, in order that we may all understand the conditions surrounding us in the world, and apply our energies in the most profitable manner for the promotion of our own and others' happiness.

Bearing this in mind, we may see an ominous sign of the times in an article which appears in the October number of the *American Journal of Sociology* describing how the Populist party in the State of Kansas, having captured the State Legislature, proceeded to make a raid on the State Agricultural College, where, after some preliminary maneuvers, they dismissed a considerable portion of the faculty, including the president, in order to insure that the doctrines taught therein should be in a line with Populist politics. The previous government of the college had been all that could be desired; there was no pretense that it had allied it-

self with any political party as such, or that the teaching given within the college walls had been other than the best thought of competent men dealing disinterestedly and honorably with their several subjects. The idea simply was that here was an opportunity for converting the college into an instrument for promoting Populist views and the success of the Populist party, and that the opportunity was too good to be lost. The first step taken was to pass a resolution to the effect that "the principles maintained by the advocates of land nationalization, public control of public utilities, and the reform of the financial and monetary system shall be fairly stated and candidly examined, with a view of leading the student to grasp the principles involved in the science of production and distribution, without bias or prejudice." To secure more complete freedom from bias or prejudice in the teaching of economics the board next proceeded to take that subject out of the hands of the president, Prof. G. T. Fairchild, who had been in the habit of lecturing on it, and sent for a man after their own heart, whom they found in a certain Professor Will. The lectures of the latter are described as presenting socialistic views as though they were beyond criticism, and as affording much satisfaction to the Board of Regents.

The next step was to declare that the employment of all the professors and instructors should expire on June 30, 1897. This gave the opportunity for getting rid of those whose views were considered in any way objectionable, foremost among whom was the president, who did not, however, wait for the expiration of the period before sending in his resignation. Out of twenty-four teachers twelve were reappointed. Henceforth, therefore, or until the political complexion of the Board of Regents changes, the

agriculture taught at the State College will be duly mingled with populism, and whatever benefit that can confer on the community at large will be duly reaped. That some benefit is expected may be inferred from a report made by the board after they had secured a new professor of political economy, in which they expressed themselves as follows: "It is not a lack of industry or unfavorable methods of farming, or the unfavorableness of the climate which have caused the widespread and ever-increasing poverty among the agricultural and laboring classes. The unremitting toil of the farmer, in which sons and daughters take part, even during childhood, has indeed yielded him large quantities of grain, great numbers of cattle, hogs, horses, and other domestic animals. He has produced enough of the useful and necessary things of life that, with fair, equitable exchange, would bring prosperity in place of poverty, comfort in place of humiliating drudgery, and content and patriotism in place of unrest and dissatisfaction." The trouble, then, is not that the farmer has not plenty of grain and animals, but that he can not exchange them on the terms he would wish for other things. Who are the people that are holding on to the other things, demanding such prices for them that trade is either impossible or very one-sided? Is it the cotton manufacturer, or the boot and shoe manufacturer, or the cabinetmaker, or the manufacturer of plows and other farm implements? We do not think any of these would acknowledge the impeachment, for if there is anything they are anxious to do it is to sell, and the prices they ask were never so low as they are to-day. We should like very much to know what remedy Professor Will would suggest in the premises. Is it not the fact that what to-day is considered poverty

would a couple of generations ago have been considered comfort? Upon another page of the *Journal of Sociology*, in an article by the editor, Prof. Albion W. Small, we read that "the toiling millions can buy with their wages more comforts than they ever could before," but that "the individual laboring man is haunted by the thought that he may any day lose his job." Well, that is where the farmer has an advantage; he is not in danger of losing his job, and, according to Professor Small, he can get more for his money than he ever could before. He may get less for his grain than formerly; but, on the other hand, he has much less labor both in producing it and in bringing it to market.

We do not propose, however, to discuss questions of political economy in these columns. The question which seems to us full of grave interest is, how far the party control of college teaching is destined to proceed. The trouble, of course, is not entirely new. In protectionist states there is but little "liberty of prophesying" for free-trade professors; but the case is more serious where parties, in the interest of their own supremacy, begin to impose the teaching of doctrines that touch the deepest foundations of society. All political control, however, in such matters is bad. The only way to have great teachers is to seek out men who have profoundly studied their several subjects, and whose disinterestedness in expounding them is beyond question. Such men may commit errors, but they will give inspiration and will so educate the judgment of their pupils as to make them incline to sound and reasonable views. He who is teaching by prescription will never teach with conviction. Truth does not need to be prescribed; it prescribes itself if it gets the chance. The greatest enemy of truth is organ-

ized self-interest, and it is precisely this enemy with which our system of higher education—in so far as it depends on State support—is beginning to be threatened. If the evil spreads, the result will be the disorganization of all State universities and colleges, because the youth of the country will not long consent to listen to lectures that express, not the thinking of an independent mind enriched by the thoughts of other independent minds, but a system of doctrine carefully adapted to help this or that party in its political struggles. Theology was a tyrant in its day, but it was a respectable, high-minded, and benevolent tyrant compared with the political party that would attempt to capture and pervert education for its own ends. Theology did not object to cramp men's minds if it could only save their souls; but the politician would do it in order to get their votes. Good will come out of evil, however, if the lesson is brought home to the popular mind that education and politics are two things that should have as little as possible to do with one another.

THE NATURE OF SCIENCE.

WE have seldom seen the difference between the science of the ancient and that of the modern world so well drawn out as it was in the Harveian oration delivered a few weeks ago by Sir William Roberts before the Royal College of Physicians in London, England. The ancients, the speaker acknowledged, "had a large acquaintance with the phenomena of Nature, and were the masters of many inventions. They knew," he continued, "how to extract the common metals from their ores; they made glass; they were skilled agriculturists; they could bake, brew, and make wine; manufacture butter and cheese; spin, weave, and dye

cloth; they had marked the motions of the heavenly bodies, and kept accurate record of times and seasons; they used the wheel, pulley, and lever; and knew a good deal of the natural history of plants and animals, and of anatomy and practical medicine." Here was a body of knowledge "of inestimable value for the necessities, conveniences, and embellishments of life." But, the lecturer went on to say, "it was not science in the modern sense of the word." Why? Because it was not "systematized and interpreted by co-ordinating principles, nor illuminated by generalizations which might serve as incentives and guides to further acquisitions." It had been acquired "mostly through haphazard discovery and chance observation," and, having no innate spring of growth, "could only increase, if at all, by casual additions—as a loose heap of stones might increase—and much of it was liable to be swept away at any time by the flood of barbaric conquest."

With the scientific possessions of the modern world the case is entirely different. They are the product of the direct and purposive efforts of the human mind, which some three centuries ago conceived the fruitful idea that the way to obtain knowledge was to go in search of it by means of observation and experiment, and not to wait for chance revelations. That idea is so familiar to us now that it is difficult to believe that it should not have been fully present to the minds of the civilized ancients. But the facts of history make it plain that it was not present to their minds. They thought acutely on many subjects, and produced an admirable literature and wonderful works of art; but they never learned the secret of interrogating Nature. Aristotle dwelt not a little on the importance of experiment and

observation; but he himself made comparatively little use of either, and his successors for many centuries, notwithstanding the extravagant authority which they assigned to his opinions, seem to have been quite uninfluenced by his suggestions on this point. They neither asked what he meant nor made any attempt worth mentioning to move forward in the direction he indicated.

Evidently the true "psychological moment," as the expression is to day, had not arrived. When it came there was, as Bacon, in words quoted by the lecturer, expressed it, "a new birth of time." Men seemed to have awaked from sleep to find themselves in possession of a new and wondrous power. They had a sense, which the ancients never had, that the discoveries they were able to make were but an earnest of greater and far more numerous discoveries yet to follow. They conceived of all the phenomena of Nature as inter-related, and foresaw that it was the destiny of human knowledge to grow into one vast, coherent, and harmonious whole. And that conception is in the world to-day, fortified by innumerable proofs derived from the victorious progress of science. The knowledge of the ancient world was unorganized, therefore it was not science: the knowledge of the modern world is organized, and therefore it is science. The knowledge of the ancient world was not a fructifying seed; the knowledge of the modern world is at once seed and harvest. The knowledge of the ancient world was not interpretative; the knowledge of the modern world symbolizes for us the powers of the universe, and the great Power in which all scattered forces find their unity. The knowledge of the ancient world was not an effectual safeguard of civilization. It is perhaps too soon to say whether modern science will safe-

guard the civilization we possess; but we incline to the opinion expressed by Sir William Roberts that the intellectual activity of our age and the varied excitements which act upon modern society exert, and will continue to exert, an "antiseptic" influence sufficient to prevent internal decay; while the advantage which scientific habits of thought confer upon the higher races of mankind will always suffice to secure them against such a fate as befell the civilization the Roman Empire.

BUSINESS THROUGH POLITICS.

THE recent political struggle through which the municipalities of the Empire State have passed has much more than a local significance. At a time when a very considerable part of the intelligence of the whole country has gone daft on the subject of municipal ownership and management of commercial enterprises, it seems needful to seize upon every pertinent and impressive occasion to point out the amazing folly of such social philosophy. Unless a halt be called, the tendency everywhere apparent, a tendency thought to be as wise as it is thought to be inevitable, the American people will have to pass through an experience much more ruinous and disappointing than any that they have ever yet had.

At the present time the duties intrusted to municipalities have become rather considerable. They include, first, the preservation of order and the protection of life and property; second, the paving and cleaning of streets and the construction and maintenance of sewers; third, provision for the extinguishment of fires; fourth, the support of public schools and certain charities; fifth, a department of public health; and, sixth, in some cases, a water-works system. Yet it is proposed to add

materially to these duties. The "new" social reformer has become convinced by his study of social science that municipalities should in every case have their own water-works system; that they should have their own gas and electric lighting plant; that they should own and run the street cars; that they should, in a word, take from the hands of private enterprise every industry that comes under that vague and inexact designation of "natural monopolies."

If the duties already intrusted to municipalities were performed with a skill and economy that evoked universal commendation, there might perhaps be something said in favor of their extension beyond the limit that Mr. Spencer has laid down, namely, the preservation of order and the protection of life and property. But what is the case? We venture to say that if any unprejudiced observer from another planet where the philosophy of Mr. Spencer is observed, had studied the municipal contests mentioned and were to express an opinion, he would say without the slightest qualification that it would be beyond human ingenuity to discover a more absurd, wasteful, and demoralizing method of doing business than the one through politics. Why it is that a truth so obvious does not thrust itself upon every thoughtful mind with an irresistible force is a mystery that must take high rank with the devotion of many intelligent people to Kneippism and other forms of quackery.

What was the problem that the elections were expected to solve? The assertion was made repeatedly that it was a very simple one, namely, whether public affairs were to be managed in a businesslike manner or in accordance with the interests of the politicians. As thus stated it

was simple; but correctly stated it was complex in the highest degree. It was to select a large number of competent men for a large number of important duties, each requiring high character and special fitness. In the case of one city having a population of one hundred and sixty thousand, which may serve as a type, there were sixty-seven such men to be chosen, not to mention the twenty constables, the two members of the Assembly, county clerk, county superintendent of the poor, and judge of the Court of Appeals. We all know how difficult it is to select one competent man for an important duty. We know, too, how often we fail. Think how much more difficult it is to select sixty-seven! Think, too, how great the chances are of failure!

But what were the steps taken to solve this problem? Were they such as would commend themselves to the proprietors of a great New England cotton mill or a great Pennsylvania steel foundry? Before each alderman, school commissioner, member of the board of public works, etc., was presented to the voters for their suffrages, were his moral character and his capacity for the duty to be intrusted to him carefully investigated and pronounced to be up to the standard required to conduct public affairs in accordance with business principles? Let the shameless intriguing at the caucuses and conventions, the despotic dictation of some party boss that placed them upon the party ticket in disregard of their moral and intellectual fitness answer this question.

It should be remembered that with certain exceptions there were two sets of candidates of this character presented to the voter for choice. What were the steps taken to enable him to select the better of the two lots? Did he listen to speakers familiar with the personal and busi-

ness record of each candidate and intent upon making to him a candid statement of the qualifications of that candidate? Did the newspapers in the city pursue the same rational plan for the enlightenment of his puzzled mind? For answers to these questions look into the speeches delivered and the articles written. There was first the claim that the candidates of the party of virtue and ability were models of integrity and capacity; and next, that the candidates of the party of vice and incapacity were monsters of iniquity and inability. If, as sometimes happened, nothing could be urged against a candidate personally, he was charged with being either a goldite or a silverite, and therefore unfit to be mayor, or an alderman, or a school commissioner. At the same time this discussion of the merits and demerits of the several candidates was carried on with a heat and often with an absurdity of argument that made the discovery of the truth about any subject or any man absolutely impossible. Is it any wonder that the voters elected some

men notoriously unfit, and defeated others of the highest character and ability?

If these statements of the problem of municipal government and the method adopted to solve it were open to question, then an enlargement of the amount of business to be done through politics might not be so absurd. But nobody impeaches their accuracy. The advocates of municipal ownership are not less vigorous in their denunciation of the evils that we have tried to describe than the opponents. When their attention is especially directed to these evils their speech becomes a prolonged jeremiad. It is only when they come to advocate what they are pleased to call in clumsy phrase the "municipalization" of gas works or street car lines that they become optimistic and insist that cities can undertake these new duties without an aggravation of the very evils they deplore. They seem to believe that by some hocus-pocus an enlargement of the sphere of politics will transmute its inherent and unavoidable vices into virtues.

Scientific Literature.

SPECIAL BOOKS.

THE purpose of Mr. *Israel C. Russell's* *Volcanoes of North America** is to make clear the principal features of volcanoes in general, and to place in the hands of students a concise account of the leading facts thus far discovered concerning the physical features of North America which can be traced directly to the influence of volcanic action. The account is comprehensive as to what it includes, and accurate so far as present knowledge extends. Regarding the western hemisphere as divided into two portions, the author assigns Central America to the northern division, because its relations as to volcanoes are closer with North than with South America. For a similar reason operating inversely, the volcanoes of the Windward Islands are regarded as South American. Much of the work is derived from the results of personal observation; but, of necessity, in so large a

* *Volcanoes of North America. A Reading Lesson for Students of Geography and Geology. By Israel C. Russell. New York: The Macmillan Company. Pp. 346. Price, \$4.*

subject, much is compiled from the works of others. The scope of the book embraces the numerous still steaming and recently extinct volcanoes of Mexico and the Central American republics, some of which have had their birth since the Spanish conquest, with examples of violent eruptions which the region furnishes; the lofty volcanic mountains of California, Oregon, and Washington, with the lava beds east of them; and still active volcanic energy in Alaska. The first chapter treats of the characteristics of volcanoes, of which the world is drawn upon for types; stages in their lives, characteristics of their products, their profiles and structure, the erosion to which they have been subjected, subterranean intrusions, and the characteristics of igneous rocks. Next is described the general distribution of the active and recently extinct volcanoes of North America. The volcanoes of Central America are enumerated, their geological relations are fixed, and they are described as "young" and "older" volcanoes, in the third chapter. The fourth chapter relates to the volcanoes of Mexico. The volcanoes of the United States are described generally through typical examples of volcanic mountains and lava sheets, and more particularly as "the great volcanic mountains of Oregon and Washington," the "Cascade Mountains," "Columbia Lava," volcanoes of the Coast Range, volcanoes of the Rocky Mountain regions, and volcanoes of Alaska. The concluding chapters are devoted to deposits of volcanic dust, and theoretical considerations, among which the interior heat of the earth, the action of pressure, the agency of water, and the chemical, mechanical, and "steam" hypotheses are noticed. The last chapter gives a very interesting description of the life history of a volcano. The book is well illustrated with charts, maps, and smaller pictures, and is supplied with a satisfactory index.

The books which for a small consideration will tell us what to eat, what to read, and even what to wear, are very plentiful; but with the exception of the pamphlet literature of the "total abstainers," whose sole interest is in water *per se* without reference to its quality, there is little information obtainable by the general reader regarding what to drink. For this reason, if for no other, such a book as the present one* ought to be kindly received. It is a treatise covering very well, in a popular way, the questions relating to the sanitation of potable waters; what water is fit to drink, the ordinary impurities, their effect on its potability, and the various methods by which the injurious contents may be removed. That the subject is an increasingly important one nobody will dispute. The growing tendency toward concentration in cities makes the water-supply question one of great difficulty, the dangers from its careless or ignorant solution being grave and far-reaching. The first chapter in the present volume gives a brief historical account of the ancient water supplies of Carthage and Rome. Drinking water and disease are next discussed. Some of the subtitles under this heading are: Paludal Poisoning, Sawdust Water, Wholesomeness of Hard Waters, Influence of Turbidity on Health, Sewage-polluted Waters, Odors and Tastes found in Waters. Chapters three and four deal with the artificial and natural purification of water. These are the most important portions of the book to the engineer and taxpayer, taking up the question of water supply in its economic and commercial

* Water Supply: Considered principally from a Sanitary Standpoint. By William P. Mason. Illustrated. New York: John Wiley & Sons. Pp. 480. Price, \$5.

aspects, both as regards the general town supply and also in reference to individual household filtration. The physical forces and forms with which we have to reckon are next considered under Rain, Ice, Snow, and River and Stream Water. In these chapters are considered the importance of a pure ice supply, the influence of forests on rainfall, and the proper care of a watershed. The care and purification of stored water is next discussed, such questions as the preparation of reservoir bottoms, growth of algæ in stored water, covered reservoirs, and lake water being taken up. The important and much-disputed questions relating to ground water receive attention in chapter eight. Among the subtitles we find: Contamination by Privy Vaults, Testing Wells for Possible Contamination, Viability of Cholera and Typhoid Germs in Soil. The reliance to be placed upon Purification by Filtration through Soil, Deep-seated Water, including the driving of artesian wells, and related questions are next discussed. Then come two long chapters on the chemical and bacteriological examination of water, the quantity of per capita daily supply, and the very important question of the action of water on metals, especially its corrosion, and solution of iron and lead pipes, form the subject-matter of the two final chapters.

The book seems to be the result of much careful work, is up to date, not technical, and fairly comprehensive. It should be owned by local aldermen and trustees, and in fact every city official whose judgment may be called upon in deciding questions relating to public sanitation and water supply; even the average householder will find much of value and interest in it, and for the modern engineer and physician it seems quite an essential part of his library. Illustrations are numerous and well chosen.

GENERAL NOTICES.

THE chapter in American history relating to the cowboy, says the editor of The Story of the West Series, introducing Mr. Hough's account of that singular character of the plains,* "demands preservation for reasons æsthetic and practical alike." It concerns a feature of American life that is passing away—has, in fact, almost passed away—never to be seen again. The story has found a competent teller in Mr. Hough, who is familiar with the cowboy's life and knows how to present its most salient features in their legitimate prominence. His book is remarkably vivacious and full of incident, and his accounts are picturesque, without his having ever found it necessary to exaggerate or descend to vulgar sensationalism. While the cowboy's life has, as the editor well says, been subjected to literary abuse, literary justice is done it in

this story, which treats it soberly and dispassionately without detracting from the raciness which "indolent and unscrupulous pens" have sought to impart to it by invention. First is presented to the reader "the long range," or the cattle trail from the south to the north, on which so many herds were driven twenty years ago in search of the fattening grasses of the north, how it was opened and how developed; then the cattle ranch, in the south and in the north; the cowboy's outfit and his horse, the marks and brands that were put on cattle, the rules or customs that grew up or were enacted concerning the use of grass and access to water; the occupations and incidents of the cowboy's business of tending cattle, described in several chapters; "society in the cow country," and the elements that came in to modify or disturb it—the "nester" or settler who established farms in the land; the great herders who tried to monopolize the country and fence it in, and the way

* The Story of the Cowboy. By E. Hough. (Story of the West Series.) New York: D. Appleton and Company. Pp. 349. Price, \$1.50.

they were opposed; the "rustler" and "the wars of the range"; and finally the growth of settlements and the changing aspects of the country. The ten full page illustrations are based upon actual knowledge.

Prof. L. H. Bailey's *Principles of Fruit Growing** is a comprehensive and thorough-going work, and appears to cover all the aspects of the subject. It does justice to the theoretical and scientific side, and is at the same time in the descriptions of the processes and appliances of fruit culture predominantly practical. The author begins with an Introductory Discussion, seeking a definition of a fruit, and finds it by enumerating the different kinds. They divide themselves into four classes, of tree fruits, vine, small, and herblike fruits, and twenty subclasses. Then he considers the geographical elements—temperature, moisture, soil, and parasite determinants—of fruit growing, the evolution of a fruit region, some economical aspects of the subject; The Location and its Climate, including site, windbreaks, and artificial protection from frost; The Tillage of Fruit Lands, their fertilization, the planting of fruit grounds, the secondary and incidental care of the plantation, diseases, insects, and spraying; and harvesting and marketing fruit. The origin of new varieties is briefly considered in the appendix, and a Bibliography of American Books on Fruit Growing is added. The author's style is direct and terse, and many of his paragraphs are very suggestive.

The great difficulty of dealing with children in disease has made this department of medicine a fertile field for the specialist. The popular notion that "almost any doctor will do for baby" is not borne out by experience. Instead of its being easier to treat a child than an adult, it is, as a matter of fact, quite the reverse, and great skill and preparation, one might almost say genius, are required for the making of a specialist in pædiatrics. Dr. Holt has given us a new work on this important subject.† He

has aimed, by omitting much material which does not strictly pertain to children and which is fully treated in general medical works, to give a fuller account of the strictly infantile diseases. Another omission, which, however, seems of less doubtful propriety, is that of questions relating to operative surgery. Rather more space than is usual in a clinical work has been given to pathology. The illustrations are fairly numerous, and are for the most part original. The material, which "is largely a record of personal experience," was gathered from eleven years, continuous hospital service among young children. The work is divided into two parts. The first of these treats of the hygiene and general care of infants, and gives some rules regarding the growth and development of the body and the peculiarities of disease in children. The second part is divided into ten sections, Diseases of the Newly Born, and Nutrition being the first two section titles. The remaining sections take up in succession the diseases of the digestive, the respiratory, the circulatory, the uro-genital, and the nervous systems. Section eight deals with the diseases of the blood, lymph nodes, and bones, and section nine the specific infectious diseases. The last section is entitled Other General Diseases.

The last volume in The Contemporary Science Series to reach us is a treatise on The New Psychology,* by Professor Scripture, of Yale University. The rapid growth of popular interest in psychology and allied branches of study has produced a large recent increase in its literature, a great share of which, however, is rather doubtful science; the subject being one difficult of experimental investigation, and of so essentially personal a nature that a student only rarely succeeds in keeping his researches purely objective. Dr. Scripture takes up the study in a methodical way, using instruments and meters wherever possible, and succeeds in bringing a sort of order out of the chaos. He has aimed to show just what the new psychology is, and to make clear the fundamental ideas of the science. The first

* The Principles of Fruit Growing. By L. H. Bailey. New York: The Macmillan Company. Pp. 507. Price, \$1.25.

† The Diseases of Infancy and Childhood. By L. Emmett Holt, M.D. New York: D. Appleton and Company. Pp. 1117. Price, \$6.00.

* The New Psychology. By E. W. Scripture. Illustrated. Charles Scribner's Sons. Pp. 500. Price, \$1.25.

part, comprising seventy-eight pages, is devoted to a consideration of methods, and is much the more important portion from a popular standpoint, because it really amounts to a discussion of the legitimacy of psychology as an experimental and exact science. The second part discusses "time" in its various psychological aspects. In Parts III and IV energy and space are respectively taken up. It will be seen from these headings that there is an attempt to divide the subject in a way analogous to that used in the study of physics. The last thirty pages of text, entitled Past and Present, give a brief history of the methods, speculations, and men connected with the study of psychology since the days of the Greeks. The book contains numerous drawings and illustrations, and several useful tables and formulæ, as appendices.

Mr. Bullock's *Introduction to the Study of Economics** fulfills well the exact purpose implied in its title. The first three chapters—which relate to the growth of the United States and their population, their land tenures and systems of labor, the growth of their foundational institutions, of the fur trade, cattle raising, fisheries, and mining, and manufactures and transportation—aim to familiarize the student with an orderly treatment of some leading facts in the economic history of the United States before the study of economic theory is begun. Throughout the book economic principles are discussed with special reference to American conditions, and their workings are illustrated by frequent allusions to American experience. The subjects of wealth, its consumption, production, and distribution, exchange, money, credit, bimetallicism, monopolies, international trade, wages, land nationalization and socialism, and the economic functions of Government are thus treated; while public finance has been only incidentally touched upon, and it has not been considered expedient to attempt to discuss taxation within the special limits of the volume. We have been much struck with the clear presentation made of principles and doctrines, of the

strong common sense that pervades the author's observations, and the general soundness of his views. A bibliography of the special subject is given at the close of each chapter, and a general bibliography of twenty-five pages and a copious index will be found at the end of the book.

The *Natural History* of the Concise Knowledge Library* is an admirable example of the manner in which much information may be presented satisfactorily in a small space. It is a book that may be held in the hand and is legibly printed, yet it covers the whole animal kingdom, and each department is treated by an expert in it, distinguished as an authority and an original investigator. It well fulfills its aim, as defined in the preface, to be concise and popular, at once accurate in statement, handy in form, and ready of reference. While giving all the technical names, the authors have sought to express themselves as much in English as possible. Hence in the text the technical terms are rendered in their English equivalents, or, where there are none such, explained in the vernacular in such a way that the most unlearned may understand what is meant. Mr. Lydekker even goes so far as to apologize for using so little technical a word as "mammals," because it has no English equivalent, "beasts" excluding man, and quadrupeds excluding man and the higher apes, and including lizards, etc. The text is preceded by a concise systematic index, giving the complete classification, and followed by an alphabetical index, containing about ten thousand references and occupying forty-six pages.

The rapid onward march of science has made necessary the revision of what was a thoroughly up-to-date book on optics † fifteen years ago. The changes we find in the new edition of Professor Le Conte's "Sight," are mainly in the form of additions. The principal of these are in Part I: a fuller expla-

* The Concise Knowledge Library: *Natural History*. By R. Lydekker, R. Bowdler Sharpe, W. F. Kirby, W. Garstang, B. B. Woodward, F. A. Bather, R. Kirkpatrick, H. M. Bernard, and R. I. Pocock. New York: D. Appleton and Company. Pp. 771. Price, \$2.

† Sight. An Exposition of the Principles of Monocular and Binocular Vision. By Joseph Le Conte. New York: D. Appleton and Company. Pp. 318. Price, \$1.50.

* Introduction to the Study of Economics. By Charles Jesse Bullock. Boston, New York, and Chicago: Silver, Burdett & Co. Pp. 571. Price, \$1.28.

nation of the cause of astigmatism, a clearer statement of the nature of space perception and the law of direction, a new mode of locating in space the visual representative of the blind spot, a brief account of "visual purple" and its probable function, and a much fuller exposition of color perception and color blindness. There is little change in Part II. Part III, where Professor Le Conte's own views are especially set forth, has been carefully gone over and verified. There have also been added a chapter on the form of phantom planes under certain conditions, and a final chapter on the evolution of the eye. Illustrations and diagrams are numerous. For a full notice of the original volume our readers are referred to the June issue of 1881.

The Sixth Annual Report of the Tennessee Bureau of Labor Statistics and Mines for 1896 calls especial attention to the growth of Tennessee as a mining and industrial State. It is shown that her mineral production was never before so large; that there has been a marked improvement in the condition of the mining properties; and that, notwithstanding the large increase in output, the number of accidents has been markedly decreased. Among the special articles we find the following titles: The Manufacture of Coke; Pig-iron Industry in 1896; Zinc, Lead, and Copper; the Phosphate Industry; and the Petroleum Field of Tennessee.

Part II of *The Report of the Alabama State Geologist* has recently reached us. It describes the so-called Coosa Valley region. Part I treating of the Tennessee Valley region. The topographic, geologic, and economic features are all considered. The geology of this section is especially difficult, because of the number of formations involved and their complexity of structure. The large economic interests here, however, make the study one of great value. The volume contains an interesting and instructive map of structure sections through various portions of the State.

Crime and Criminals (Chicago: W. T. Keener Co., \$1) is substantially a reproduction of a series of articles contributed by the author, *J. Sandersen Christison*, under the title of Jail Types, to a Chicago journal. They are given in book form in response to

the favorable notices they receive. They consist of sketches—life histories with characterizations of individual criminals, with photographic profile and full-face portraits. The author suggests that those who read them may find much to reflect upon in the line of duty as members of society at large. The delinquents are regarded, from the psychological point of view, as belonging to the three classes of the insane, the moral paretic, and criminals proper.

In *The Science of Speech* (Washington: The Volta Bureau) *Alexander Melville Bell* offers an explanation of all the actions of the mouth and the vocal organs which produce speech. While in the system of visible speech the elements of language are exhibited in symbols, by which some beginners may be deterred, in the present work the same elements are described without symbols, with the formation of the sounds expressed in the nomenclature. Hence the author styles it a species of shorthand for the mechanism of utterance.

The sixth volume of the *Report of the Iowa Geological Survey* (*Samuel Calvin*, State Geologist) includes the reports on Lead and Zinc Deposits, by A. G. Leonard; The Sioux Quartzite and Certain Associated Rocks, by S. W. Beyer; the Artesian Wells of Iowa, by W. H. Norton; and the Relations of the Wisconsin and Kansas Drift Sheets in Central Iowa, and Related Phenomena, by H. Foster Bain. The lead and zinc deposits extend along the Mississippi River for nearly eighty miles, in the counties of Dubuque, Clayton, and Allamakee. Mr. Norton's paper on Artesian Wells is a full and elaborate study of the subject.

The *Bulletin of the United States Fish Commission*, Volume XVI, for 1896 (*John J. Brice*, Commissioner), contains a report, by Barton W. Everman, upon Salmon Investigations in the Headwaters of the Columbia River, in the State of Idaho, in 1895, together with notes upon the fishes observed in that State in 1894 and 1895; and papers on the Artificial Propagation of the Rainbow Trout, by George A. Beagle; The Russian Fur Sea Islands, by Leonhard Stejneger; The Artificial Propagation of Salmon on the Pacific Coast of the United States, with Notes on the Natural History of the Quinal Salmon,

by Livingston Stone; and Deep-Sea Exploration, with a general description of the steamer Albatross, her appliances and methods, by Z. L. Tanner.

The *Fourteenth Annual Report of the Bureau of Ethnology* for 1893-'94 (J. W. Powell, Director) presents the results of a full year of study by the members of the Bureau, the publication of which in book form has been so delayed that they are hardly longer new to the public, and several authors whose works are referred to in the administrative report—Mallery, Pilling, Dorsey, among them—have died. The administrative report gives a clear account of the classification of the work of the bureau, and of the labor of its agents in various fields, showing that a large amount of information is being accumulated, while the original and living sources are still accessible, which might, if the studies were long delayed, be irrecoverably lost, and which is destined to be of incalculable value to students of mankind. The special papers, published in full with ample illustration, are Stone Implementments of the Potomac-Chesapeake Tidewater Province, by W. H. Holmes; The Siouan Indians, a Preliminary Sketch, by W. J. McGee; Siouan Sociology, a Posthumous paper, by J. O. Dorsey; Tusayan Katchinas, by J. W. Fewkes; and The Repair of Casa Grande Ruin, Arizona, by Cosmos Mindeleff.

Part second of Volume XXVI of the *Annals of the Astronomical Observatory of Harvard College*, comprising *Miscellaneous Investigations of the Henry Draper Memorial*, gives first a Review of Progress during the Years 1891 to 1894, followed by accounts of Observations on the Distribution of Stars in Clusters, Measurement of Positions and of Brightness and Spectra of Stars in Clusters. These articles are illustrated by eleven excellent photographic plates, recording and communicating to the eye what was seen.

The *Seventeenth Annual Report of the United States Geological Survey*, covering the work of the fiscal year 1895-'96, is published in two parts, constituting two very large volumes of 1076 and 864 pages. The first part, besides the director's report, in which the work of the various branches of the survey is described, contains papers on Mag-

netic Declination in the United States, by Henry Gannett; A Geological Reconnoissance of Northwestern Oregon, by J. S. Dittler; The Geology of the Sierra Nevada, by R. W. Turner; The Coal and Lignite of Alaska, by W. H. Dall; Glacial Brick Clays of Rhode Island and Southeastern Massachusetts, by N. S. Shaler and others; and the Eocene and Upper Cretaceous of the Pacific Coast, by T. W. Stanton. The second part contains papers on the Gold-Quartz Veins of Nevada City and Grass Valley, by Waldemar Lindgren; Geology of Silver City and the Rosita Hills, by W. Cross; the New and Kanawha Rivers, by M. D. Campbell and W. C. Mendenhall; The Underground Water of the Arkansas Valley, by G. K. Gilbert; The Water Resources of Illinois, by Frank Leverett; and Artesian Waters of a Portion of the Dakotas, by N. H. Denton.

Extension Bulletin No. 20 of the University of the City of New York is also Public Libraries Bulletin No. 6, and embodies the report of the Public Libraries Division for 1896, including statistics of New York libraries.

The *Bulletin* of the Department of Labor for September, 1897, contains articles on the inspection of factories and workshops in the United States; the mutual rights and duties of parents and children; the municipal or co-operative restaurant of Grenoble, France; digests of recent reports of five State Bureaus of Labor Statistics and of recent foreign statistical publications; decisions of courts affecting labor; and recent State laws relating to labor.

The *Report of the Chief of the Weather Bureau* for the year ending June 30, 1896, besides the usual meteorological tables and related matter for the year, briefly treats of new work undertaken with a view of improving the bureau service, special improvements made during the year, and the preparation and distribution of forecasts and warnings. Noticeable features are the paragraphs about observations with kites and international cloud observations, and the paper, illustrated with charts, on tornadoes since 1889.

To their Library of Useful Stories D. Appleton and Company add *The Story of the Earth's Atmosphere* (price, 40 cents), in which the author, Douglas Archibald, of the Royal

Meteorological Society, London, seeks to put forward the main features of our knowledge of the conditions that prevail in the atmosphere as they are interpreted through the science of to-day. He has written not for the minority, who vaguely wonder at the relation of extraordinary facts and pass on, but for the more numerous class who, besides the facts, want to know the reason why. In successive chapters he presents briefly in clear style the different qualities, phenomena, and operations of the atmosphere, including precipitation, storms, sounds, and colors, and devotes a chapter to flight and another to life in the atmosphere. The latest developments of exploration by kites are explained.

The *Report of the Commissioner of Education for 1895-'96*, besides the usual departmental information and national and State statistics, contains many papers of value and interest; among which we mention those on laws relating to city school boards, education in various European and South American countries, schools in certain Middle and Southern States during the first half of the century (by A. D. Mayo), music in German schools, libraries and library legislation, the Fifth International Prison Congress, Jewish schools two thousand years ago, correlation of studies, a biography and bibliography of Horace Mann, and an article that savors much of old times and is, withal, very entertaining, on early educational life in middle Georgia.

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Fragments of Science.

Chinese White Wax: a Curious Industry.

—George F. Smithers, consul at Chung-king, China, is authority for the following: In the Chien-ch'ang Valley, and especially in the neighborhood of Chung-king, which is the chief wax-producing country, perhaps the most prominent tree is the *Ligustrum lucidum*, or "insect tree." It is an evergreen, with dark-green, glossy, ovate leaves springing in pairs from the branches. On these trees, attached to the bark, are numerous brown, pea-shaped excrescences. The larger of these scales are readily detachable, and when opened present either a whitish-brown pulpy mass, or a crowd of minute animals looking like a mass of flour. Upon close examination these masses are found to consist of a swarm of brown or dirty-white creatures, each provided with six legs and a pair of antennæ. This is the white-wax insect, the *Coccus pe-la* of Westwood. Many of the scales also contain either a small white bag or cocoon covering a pupa, or a perfect imago in the shape of a small black beetle. This beetle is a species of *Brachytarsus*. If left undisturbed in the broken scale, the beetle, which from his ungainly appearance is called by the Chinese *nin-érh* (buffalo), will continue to burrow in the inner lining of the scale, which is apparently his food. The Chinese declare that the beetle eats his minute companions in the scale. When a scale is plucked from a tree, an orifice where it

was attached to the bark is disclosed. By this orifice the cocci are enabled to escape from the detached scales. Two hundred miles to the northeast of Chien-ch'ang, and separated from it by a series of mountain ranges, is the prefecture of Chia-ting, within which insect white wax as an article of commerce is produced. At the end of April the scales are gathered from the trees, made up into paper packets, each weighing about sixteen ounces, and transported by porters across the mountains to Chia-ting. Great care has to be taken in the transit of the scales. The porters travel only during the night, as the high temperature during the day would cause a too rapid development of the insects and their escape from the scales. Notwithstanding the greatest precautions, however, each packet loses about an ounce in transit. West from the right bank of the Min River, on which the city of Chia-ting lies, stretches a plain to the foot of the sacred O-mei range of mountains. This plain is an immense rice field, being well watered by streams from the western mountains. Almost every plot of ground here, as well as the bases of the mountains, are thickly edged with stumps, varying from two or four to a dozen feet in height, with numerous sprouts rising from their gnarled heads. These stumps resemble at a distance our own pollard willows. The leaves spring in pairs from the branches; they are light green, ovate, serrated, and

deciduous. It is probably the *Fraxinus chinensis*, a species of ash. The tree is known to the Chinese as *pai la shu* (white-wax tree). On the arrival of the scales from the Chien-ch'ang Valley, they are made up into small packets of from twenty to thirty scales, each inclosed in a leaf of the wood-oil tree. The edges of the leaf are tied together with rice straw, by which also the packet is suspended close under the branches of the wax tree. A few holes are made in the leaf, so that the insects may find their way through them to the branches. On emerging from the scales the insects creep along the branches to the leaves, where they stay for a period of thirteen days. They then descend to the branches and twigs, the females probably to provide for a continuation of the race by developing scales in which to deposit their eggs, and the males to excrete the substance known as white wax. Whether or not this wax is normally intended as a protection for the scales is uncertain. The wax first appears as a white coating on the under sides of the boughs and twigs, and looks very much like sulphate of quinine. It gradually spreads over the whole branch, and attains after three months a thickness of about a quarter of an inch. The branches are then lopped off and as much of the wax as possible removed by hand. This is placed in a pot of boiling water. The wax, melting, rises to the surface, is skimmed off, and placed in a round mold, whence it emerges as the white wax of commerce. An inferior darker quality is made by boiling twigs and all together. When the branches are lopped off a wax tree, a period of three years is allowed to elapse before the tree is again used. Since the introduction of kerosene oil into China the use and hence production of this wax have much decreased, it having been largely used as an external coating for candles on account of its high melting point (160° F.).

Psychic Development of Cats and Dogs.

—Prof. Wesley Mills's experiments on the psychic development of young animals continue to be very interesting. In the kitten, while the first stages are very slow and obscure, the author finds that in the progress of all the senses to full development the course, while marked by definite steps, is often so rapid that distinct advances may

be marked in a single day. Apart from the senses, etc., there seems to be a definite order in which all the features of feline nature appear, as, for instance, purring, crouching, stalking, etc. Certain physical changes are correlated in time with certain psychic developments, the significance of which is in some cases clear, in others obscure. Comparing the two animals, the cat, on the whole, develops more rapidly than the dog, the greatest difference between them appearing in the social and gregarious nature of the dog and the independent and solitary traits of the cat. The dog is docile in the highest degree; the cat to a slight degree, compared with its intelligence. The play instinct is early and highly developed in both, and the peculiar qualities of each are well exhibited in the manifestation of it. In will power and ability to maintain a separate existence the cat is superior to the dog. In the higher grades of intelligence the wisest dogs are much in advance of the most knowing cats; and this is foreshadowed if not exemplified in the early months of existence. The nature of the dog as compared with the cat tends to beget prejudices in his favor with the mass of persons, so that in general the dog is overestimated and the cat underestimated with the great majority; at the same time the dog's nature is much nearer that of man than the cat's. "The kitten may amuse, but even a puppy dog touches chords of sympathy in the heart of man that the cat can never reach."

An Incandescent Oil Lamp.—Ever since the successful introduction of the incandescent mantle in gas lamps, inventors have been hard at work trying to construct an oil lamp which could be used to replace the gas in heating the mantle. Many such lamps have been contrived, but up to the present time none of them have proved satisfactory. It is now announced, however, in Industries and Iron, that such an oil lamp having an atmospheric burner has recently been offered for inspection in London, which seems to be free from most of the defects of its predecessors, and which promises to become a great commercial success. It is called the "Era" incandescent petroleum burner, and consists of a "gallery burner," spreader, mantle, and chimney—in fact, everything

necessary except the oil container. The mantles are of special form, being somewhat shorter and apparently broader than those used for coal-gas burners, and the mesh of the material is more open. It is claimed that the lamp will give a fifty-candle light, with rather less than one third the oil consumption customary with a burner of the ordinary type having equal illuminating power. The air blast, which is necessary for converting the luminous flame into a heating one, is secured by the use of an unusually long chimney. The adjusting of the flame to its proper height is effected by the ordinary rack mechanism operating on the wick case and wick. If the flame is too high it begins to "sing," and this serves as a ready means for regulating it. It is stated that the complete apparatus, with spare gallery and cap, is sold retail at about \$2.40, and can be fitted to any type of lamp having a fourteen-line cylindrical burner.

Chemistry of a Silk Jacket.—Dr. T. L. Phipson has recently had occasion to analyze a piece of black dress silk of medium quality, at the request of a lady who wished to ascertain its value. The results are curious. The material contained a large quantity of substance that was not silk at all, being considerably "weighted." It would not burn with flame, but smoldered away like tinder and left a large amount of ash, the principal ingredient of which was oxide of tin. The precise composition was: Water, 11.43 parts; ash (mostly oxide of tin and silica), 14.30; real silk, 28.14; organic matters, etc., not silk, 46.13; in all, 100 parts; nitrogen, 4.76 parts. Respecting the tin, the author observes that he has examined specimens of poor tin ore from Cornwall that did not contain more tin than this material for a lady's blouse; "and I at once realized the fact that the silk dresses worn by the ladies we see daily parading in Regent Street and Bond Street, taken together, would represent a Cornish mine of very fair quality." The analysis brought to light the fact that the durability of a piece of silk can be determined by this method. The probable life—that is, the length of time before it would become "utterly shabby, greasy-looking, and showing the threads"—was estimated by a milliner at about three months.

It is said, however, that the public prefer the cheap products that get shabby so soon because the fashions change so rapidly that it would be useless to buy silk of better quality.

A Primitive Maya Jewsharp.—Mr. M. H. Saville gives the following interesting information in a recent note in the *American Anthropologist*: The ancient forms of musical instruments known to have been used in Yucatan have been almost entirely superseded by those introduced since the Spanish conquest. In some of the interior pueblos the *tunkul*, or ancient wooden drum, is still used on feast days. "During the winter of 1890-'91, while engaged in explorations at the cave of Loltun, we employed a number of Mayas who came from small villages in the interior remote from Spanish influences. Their evenings were passed in singing plaintive melodies in their native tongue, accompanied by a primitive form of stringed instrument which I have never seen described. It was called *kool*, and consisted of a piece of ropelike vine (*ohil*) stretched between the two ends of a pliable stick, making a bow about two feet long. One end of this bow is placed near the face, about one third of the distance from the end, so that the mouth covers but does not touch the string, forming a resonator. Between the string and bow a piece of wood is placed in such a manner that it may be pressed against the string or relaxed at will. The tones are produced by tapping on the string, and somewhat resemble those made in playing a jewsharp, but are more agreeable to the ear. Variation of tone was produced by varying the pressure of the stick upon the string and also by the opening or partial closing the mouth. The music is weird and not unpleasing."

The Jesup Expedition.—The object of the Jesup expedition to the North Pacific, as explained by Prof. F. W. Putnam in the British Association, is to study the question of the supposed Asiatic origin of the ancient American peoples. The whole cost of the expedition is to be paid by Mr. Morris K. Jesup. A thorough and careful exploration will be made of both sides of the Pacific Ocean north of the Columbia River in America

and of the Amoor in Asia. Several parties will be placed in the field, each including a thoroughly qualified ethnologist, a physical anthropologist, and an archæologist, who will make comparative studies of the physical characteristics of the different peoples, their languages, their myths and traditions, their customs and arts, and will also study the archæology of the whole region. Dr. Boas has been in the field since June, 1897, in British Columbia, and has established four parties, who are working under his immediate direction. The first party will go to Asia in the spring, and other parties will be put into the field from time to time as the men are selected who are properly prepared for the work. In the discussion which followed the presentation of this account, Professor Putnam expressed his belief that there had been an American-Asiatic contact. Mr. Frank H. Cushing was of a different opinion, and thought that the resemblances between the arts and customs of aboriginal Americans and Asiatics were merely the results of similar psychic developments under corresponding environments. Professor Morse brought forward data that led him to the conclusion that not a dialect, art, tool, or weapon was found in America at the time of the discovery that had been in use in the Old World.

Object Lessons in Road Building.—The following, in a circular of information from the New York Agricultural Experiment Station at Geneva, will be of value to all interested in the good-roads problem: The attempt to stimulate and inform the public mind in the direction of good roads is being undertaken in two ways: first, by the distribution of good roads literature; and, second, by the building of sample roads in connection with State colleges and experiment stations. The first sample road to be built is already completed at New Brunswick, N. J. (this was written about the first of August), and the second one, which is being constructed in connection with the Geneva station, is now in its first stages. This sample road, which has been made possible through the generosity of private citizens and through liberal aid from the town and city of Geneva, will be over seven thousand feet long, being located in an important street which connects

the experiment station with the city. A section of this, perhaps eight hundred feet, will be macadamized in the center to the width of eight feet, with rolled dirt roads on either side, this being designed as an improved country road. The remainder, something over a mile, will be macadamized in the center fourteen feet, with dirt roads on either side. It is now also proposed to lay at least two hundred feet of the steel track which is now attracting so much attention as a possible efficient and economical road in sections where stone is scarce and costly.

A Troublesome "Water Weed."—About seven years ago a few plants of the water hyacinth were accidentally thrown into the St. John's River in Florida. Since then they have increased so enormously as to prove a serious obstruction to navigation, so much so indeed that about two years ago it was found necessary to call in the aid of the War Department. Still later, in the early part of 1897, the Department of Agriculture sent one of its agents, Mr. Herbert Webber, to the region in order to investigate more fully the physiology and habits of this dangerous vegetable. His report has been recently published and is authority for the following statements: The plant grows chiefly in sluggish fresh water, the character of the water seeming to have much to do with its growth. It can not live in brackish water, and is promptly killed when it is dislodged and floats down into salt water. It is normally propagated by seeds and stolons. When the plant first appeared in the river its beautiful masses of flowers were much admired, and it was introduced at various points for its beautifying effect. At this time no one expected the plant would become a nuisance. In a very short time, however, it began to seriously interfere with navigation, and its effect on the lumber and fishing industries has been most disastrous. It is feared that its eradication is impracticable.

Unexplained Tidal Variations.—It has been demonstrated by Lord Kelvin and Professor Darwin that the tidal movement is made up of many waves, depending upon different functions of the moon and sun. Some of these movements are half daily, some daily. The tidal movement is nowhere

more simple and regular, says Captain W. J. L. Wharton, than in the British Isles, in remarkable contrast to the opposite American coast, where it is very complicated. The minor tides, which in most parts of the world considerably affect the volume of the whole, are in Great Britain comparatively insignificant; why, is not yet explained. Some curious interference phenomena originating in the meeting of tidal waves from opposite directions, or in rebounds from the coasts, have been observed in the British Isles. The tidal range of about fifteen feet on the western part of the southern coast of England diminishes as we go eastward to one of six feet near Poole, then increases to Hastings, where it is twenty-four feet, and then, farther east, gradually diminishes. This is due to reflection from the French shores, which brings waves that here re-enforce, there reduce, the main wave, according to details so complex that they have not yet been studied out. Variations in the mean range of tides on many coasts may be accounted for as resulting from such reflections, which may come from longer distances and be more numerous than we are now aware of.

Toads at Dinner.—The toad does not take dead or motionless food. Only living and moving insects, centipeds, etc., are devoured, while worms or other larvæ disturbed by their hopping are safe so long as they remain curled up; but as soon as they move they are captured. The toad's tongue, its only organ for seizing food, is soft, extensible, attached in front but free behind, and is covered with a glutinous substance that adheres firmly to the food seized. So rapid is the motion of this weapon that a careful watch is necessary in order to see the animal feed. At night, soon after sunset or even before on cool evenings, the toad emerges from its shelter and slowly hops about in search of food. Something of a regular beat is covered by these animals, whose sense of locality is strong. In the country this beat includes forage along the roadside, into gardens and cultivated fields, and wherever insect food is abundant and grass or other thick herbage does not interfere with getting about. In cities and suburban villages the lawns, walks, and spots beneath the electric lamps are favorite hunting grounds. At Am-

herst, Mass., Mr. A. H. Kirkland, from whose paper we derive these observations, once counted eight large, well-fed toads seated under an arc light and actively engaged in devouring the insects which, deprived of wings, fell from the lamp above. At Malden, Mass., a colony of about half a dozen toads sally forth on summer evenings from under the piazza of a citizen's house, go down the walk, cross the street, and take up their stations under the arc lamp, where they feed upon the fallen insects till the current is turned off, when they return to their accustomed shelter.

Unexplored Regions in Asia.—In the coming century there will be abundance of work for explorers in Asia, said Dr. J. Scott Keltie in the British Association, and plenty of material to occupy attention. They lie in two separate regions. In southern and central Arabia there are tracts which are entirely unexplored. These regions are probably a sandy desert. At the same time they are, in the south at least, fringed by a border of mountains, whose slopes are capable of rich cultivation, and whose summits the late Mr. Theodore Bent found to be covered with snow. If any traveler cared to face the difficulties, physical, political, and religious, which would probably be met with, he might be able to tell the world a surprising story. Another region in Asia where real pioneer work still remains to be done is Tibet and the mountainous districts bordering it on the north and east. Lines of exploration have in recent years been run across Tibet by Russian expeditions like that of Prejevalsky, by Rockhill, Prince Henry of Orleans, Bonvalot, Bower, Littledale, Wellby, and Malcolm. From the results obtained by these explorers we have formed a fair idea of this, the most extensive, the highest, and the most inhospitable plateau in the world. The forbidden city of Lassa is at present the goal of several adventurers, although as a matter of fact we can not have much to learn in addition to what has been revealed in the narrative of the native Indian traveler, Chandra Das. The magnificent mountain region to the north and east of Tibet furnishes a splendid field for the enterprising explorer. Then there are the series of parallel mountain chains south-east of Tibet through which the upper waters

of the great eastern Asiatic rivers run; a region in Turkestan; the Malay Peninsula; and the great islands of the Malay Archipelago and the Philippines.

MINOR PARAGRAPHS.

THE last bulletin of the Hatch Experiment Station gives some interesting information regarding the nitrogen germ fertilizer. Hellriegel and his collaborators have established by careful observation the fact that leguminous plants, like clovers, beans, vetches, lupines, etc., with the assistance of certain root bacteria found in the soil, can utilize the nitrogen of the air for the formation of nitrogen plant food fit for the support of their growth. These micro-organisms fasten themselves upon the roots of the clover, penetrate the epidermis, and form in the course of their growth swellings, nodules, or tubercles of varying size or shape. Their presence and growth in the tissue of the roots of this class of plants are considered an essential condition for the conversion of the elementary nitrogen of the air into suitable nitrogen plant food. One of the latest developments in this direction is the appearance in the general market of patented germ fertilizers for leguminous crops.

THE crude materials for the manufacture of carborundum at Niagara Falls are sand, coke, sawdust, and salt. These are ready for use except the coke, which has to be ground to a fine powder. The furnaces are built of brick and have the form of an oblong box about sixteen feet in length and five feet in width and depth. In the center of either end are the terminals, consisting of sixty carbon rods thirty inches long and three inches in diameter. The mixture is thrown into the furnace, convection made with the dynamo, and after twenty-four hours the process is complete. The carborundum occurs in the center of the mixture as bright radiating crystals. In order to prepare the carborundum for the market it is first placed under heavy iron rolls for the purpose of crushing apart and separating the individual crystals, which are then washed in a solution of acid and water to remove solubles, and finally dried and sifted to separate the different-sized crystals. During the year 1896 the carborundum company

produced in round numbers 1,191,000 pounds of crystalline carborundum. Carborundum is used chiefly as an abrasive, for which it is especially well suited, owing to its excessive hardness, which closely approaches that of the diamond.

AN interview with the physician in ordinary to the living Buddha of Ourga educed the following statements regarding Mongolian medicine: Mongols do not dissect, hence their anatomical knowledge is very limited. They fix the number of diseases at four hundred and forty. Works on medicine are very numerous, the chief one being a kind of encyclopædia entitled *Khlantap*. Their methods of physical examination are like Sam Weller's knowledge of London, "extensive and peculiar." Thus more than seventy varieties of pulse are described. Urine analysis is insisted on, and sometimes extends as far as tasting. Their pharmacopœia is mainly composed of vegetable substances. Aromatic plants, such as cinnamon and benzoin, play a large part in their therapeutics. The true medical man is not allowed to practice surgery, but in cases of crushed limbs where amputation is necessary, the physician may direct a butcher how to use the knife.

THE pre-Columbian inhabitants of Mexico and Central America made very durable paper from the leaves of the maguey or century plant. In one of the records preserved upon this paper we are informed that twenty-four thousand reams of it were to be brought yearly as tribute to the storehouses of the ruler of Mexico—Tenochtitlan. Two cities are named as the principal places of manufacture, Yzamatillea and Amacoztilla. The people used the paper not only for books, but, like the Japanese and Chinese, for flags, banners, ribbons, clothing, etc. It was prepared by soaking and macerating the leaves of the maguey, and then beating them into thin sheets, which were either varnished or coated with animal membranes. The codices, or Aztec and Mayan records, were printed on long, narrow strips and then

folded up like a screen, with a board cover at each end. Both sides of the paper were used.

NOTES.

TILL about two years ago all the fuller's earth used in this country was imported. About that time deposits were discovered in Florida. After these, a paper by Mr. Heinrich Ries says the most extensive beds so far found have been in South Dakota. At Fairburn the earth passes upward into the sandy clay, but in its purer portions is a yellowish, gritty clay, with a somewhat nodular structure. The individual nodules are dense, and break with a conchoidal fracture. The earth at Argyle is exactly similar to this, but that at the Minnekahta beds is entirely different. The Fairburn and Argyle earths have been tested in the clarification of cotton seed oil, with excellent results.

MR. O. H. HOWARTH, speaking in the British Association of various strains to which the earth is subjected in its motions around the sun and upon its own axis, ascribed to them the chief responsibility for cracks in the rocky coating of the earth. He supposed that while gravitation tends to draw all the heavier minerals to the center of the earth, this process of shaking or breaking and constant readjustment suffices to spread them out again in the form of fissure veins. The theory was experimentally illustrated by kneading pieces of colored matter in plastic clay, when in a short time little veinlike markings were produced. Possibly such ever-present and ever-shifting strain might account for the disturbances to be seen in the sun.

It has long been recognized that arsenical wall papers do serious mischief, but it has been much disputed as to just how the arsenic is liberated. This point has recently been cleared up by the researches of Gosio and Emmerling. Certain molds, including the very common *Mucor mucedo*, have been found to have the remarkable property of decomposing arsenical compounds, with the evolution of volatile products containing arsenic of a highly poisonous character.

SOME analyses of coal from the pre-carboniferous rocks of Canada communicated to the British Association by Professor Ellis, of Toronto, showed in a very striking way the gradual transition from petroleum and its immediate product of decomposition, asphalt, to anthracite and pure carbon.

A COMMITTEE for the promotion of agriculture, with Sir John Evans as chairman, was appointed by the British Association to look into the methods and results of the agricultural experiment stations in Canada and other countries, with a view to establishing a similar institution in Great Britain.

THE death has been recently reported of Dr. Holmegren, professor of physiology in the University of Upsala, Sweden. He was born in 1831, and was appointed to his professorship in 1867. He established the first physiological institute in Sweden; but was best known abroad for his researches on color blindness, and his plan of testing the color sense by means of wools of various shades.

DR. EDMUND DRECHSEL, professor of physiological and pathological chemistry and of pharmacology in the University of Bonn, died of heart disease, September 22d, at the Naples Zoölogical Station, where he was investigating the chemistry of the invertebrates. Previous to going to Bonn, he was assistant professor at Leipsic. He published many contributions to physiological chemistry.

DR. GEORGE H. HORN, who died in Philadelphia, November 25th, was one of the most eminent entomologists in America, and was president of the Entomological Society. He was also for many years secretary of the American Philosophical Society, and discharged the duties of that office and of librarian till about a year ago, when he was attacked with paralysis. He served, moreover, for some time as corresponding secretary of the Academy of Natural Sciences of Philadelphia.

THE obituary list for the month includes the names of the following men known in science: The Rev. P. B. Brodie, of Rowington, England, geologist and student of fossil insects, November 11th, aged eighty-two; Prof. Ernst Schering, director of the magnetic department of the observatory at Göttingen, November 2d, aged sixty-four; Sir Rutherford Alcock, formerly president of the Royal Geographical Society, November 2d, aged eighty-eight; C. E. Colby, professor of organic chemistry in Columbia University; Dr. Harrison Allen, emeritus professor of comparative anatomy in the University of Pennsylvania, November 14th; Sir Henry Doulton, founder of the Lambeth Potteries, November 17th, aged seventy-seven; Dr. G. H. Otto Vogler, author in geology and natural history, October 18th, aged seventy-five; Prof. Henry Calderwood, Edinburgh, writer on philosophy and evolution; Dr. J. Frenzel, director of the Biological Station on the Muggelsee, near Berlin; Dr. L. A. Büchner; Prof. Karl Müller, of Hildesheim; Dr. M. Foster Heddle, mineralogist and twenty-two years professor in the University of St. Andrews; Dr. F. Stohmann, honorary professor of agriculture in the University of Leipsic; Dr. Leonhard Sohnke, professor of experimental physics in the Technical High School, Munich, aged fifty-five; and the Rev. Samuel Haughton, M. D., former professor of geology in Trinity College, Dublin, and writer on various subjects in science.



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THE EVOLUTION OF THE MIND.

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THE mind, in the sense in which I shall here use the word, is the collective function of the sensorium or brain of man and animals. It is the sum total of all psychic changes, actions, and reactions. Under the head of psychic functions are included all operations of the nervous system, as well as operations of like nature which take place in creatures without specialized nerve fibers or nerve cells.

As thus defined, mental operations are not necessarily or exclusively conscious. With the lower animals nearly all of them are automatic and unconscious. Even with man, most of them must be so. But between the automatic and the conscious actions no sharp line of division exists. All functions of the nervous system are alike in nature, and from the present point of view may be considered together. Consciousness is not an entity, but a condition. It stands related to mind much as flame is related to fire.

It is a recognized law in biology that "function precedes structure." To define this law more exactly, we should say that function precedes the differentiation of the organ on which it depends. There is a certain work to be done, and a certain body of cells are set apart sooner or later to do it. Just as plowing was done in some fashion before the invention of the plow, so in some manner respiration was accomplished before the development of gills and lungs. Something of mental action came before there was ever an organized brain.

In the animals of one cell, or protozoa, breathing and digestion are each performed by the whole body. In the division of labor or

specialization which arises in the higher or many-celled animals, certain alliances of cells or tissues are set apart for respiration alone, and certain others for digestion, while other functions of animal life are relegated to still other cell alliances. Each organ in turn is released from all functions except its own.

Irritability, or the response to external stimulus, is an attribute of all living organisms. In the method and degree of response variations occur. These variations favorable to the division of labor and the adaptation of the animal to its surroundings are seized and fixed by natural selection. In this way, on the basis of a diffused function, an organ is built up and the organ itself is specialized and perfected.

The mind and consciousness of man grow out from the irritability of the lower animals. They are developed through series of successive differentiations and integrations. All the higher animals are colonies of co-operating and co-ordinated cells. In such colonies of units the functions of sensation, thought, and motion are relegated to series of the most sensitive and most highly organized cells. This alliance of cells is adequate for the work it has to perform. The brain is always adequate for the mind, for the one is the organ, the other the function, and the development of the two must go on together.

The intellect of man can not be regarded as the crowning marvel of the "great riddles of life." A marvel is no greater for its bigness. Life is one continuous marvel, without break or end. The human mind is one of life's manifestations. The marvel appears in great or small psychic powers alike, for the great powers of the many-celled brain are produced by the co-operation and specialization of the small powers of the single cell. Nature knows neither great nor small. "God works finer with his hands than man can see with his eyes." The single cell is far from simple. The egg or germ cell carries within itself the whole machinery as well as the whole mystery of heredity. The simplest organism we know is far more complex than the Constitution of the United States. Its adjustments, checks, and balances are more perfect. It should in its changing relations be compared rather with the great unwritten constitution of civilized society. The laws of society spring from the laws governing the development of the single cell. If we knew the latter "all in all," as Tennyson says of the flower, "we should know what God is and man is."

If we could know all of any life problem to its uttermost detail, we should have the clew to all life.

Among the protozoa, as already stated, all activities are centered in the single cell which forms the animal unit. Each cell is suf-

ficient unto itself. It is independent and free, but it is at the same time unspecialized and ineffective. Its career offers no scope for volition, for a single life unit can not control the elements which surround it. It is the sport of the wind and the wave. But the recognition of self and non-self, which in one form or another is the attribute of all life, is not wanting among the protozoa. Some of them develop this sense to a large degree. It is said that among the rhizopods are those whose appendages or pseudopodia are at once cast off if they come in contact with the appendages of another of the same species. This recognition of self and non-self is not intellect, but it is homologous with the impulses on which in the higher types personality depends.

All sensation has reference to action. If a creature is not to act, it can not feel. Wherever motion exists there is some sensitiveness to external conditions, and this is of the nature of mind. In a compound organism the nature and position of the sensorium or mind center depend on what it has to do, or rather on what were the duties the same structure had to perform in the life of the creature's ancestors.

A plant may be defined as a sessile animal. It is an organic colony of cells, with the power of motion but not that of locomotion. The plant draws its nourishment from inorganic Nature—from air and water. Its life is not conditioned on a search for food, or on the movement of the body as a whole.

The plant searches for food by a movement of the feeding parts alone. In the process of growth, as Darwin has shown, the tips of the branches and roots are in constant motion. This movement is in a spiral squirm. It is only an exaggeration of the same action in the tendrils of the growing vine. The course of the squirming rootlet may be deflected from a regular spiral by the presence of water. The moving branchlets will turn toward the sun. The region of sensation in the plant and the point of growth are identical, because this is the only part that needs to move. The tender tip is the plant's brain. If locomotion were in question, the plant would need to be differently constructed. It would demand the mechanism of the animal. The nerve, brain, and muscle of the plant are all represented by the tender growing cells of the moving tips. The plant is touched by moisture or sunlight. It "thinks" of them, and in so doing the cells that are touched and "think" are turned toward the source of the stimulus. The function of the brain, therefore, in some sense exists in the tree, but there is no need in the tree for a specialized sensorium.

The many-celled animals, from the lowest to the highest, bear in their organization some relation to locomotion. The animal feeds

on living creatures, and these it must pursue if it is to thrive. It is not the sensitive nerve tips which are to move; it is the whole creature. By the division of labor, the whole body of the compound organism can not be given over to sensation. Hence, the development of sense organs different in character, one stimulated by waves of light, another by waves of sound; one sensitive to odor, another to taste; still others to contact, temperature, muscular strain, and pain. These sense organs through their nerve fibers must report to a sensorium, which is distinct from each one of them. And in the process of specialization the sensorium itself is subdivided into higher and lower nerve centers—centers of conscious thought and automatic transfer of impulse into motion. This transfer indicates the real nature of all forms of nerve action. All are processes of transfer of sensation into movement. The sensorium or brain has no knowledge except such as comes to it from the sense organs through the ingoing or sensory nerves. It has no power to act save by its control of the muscles through the outgoing or motor nerves. The mind has no teacher save the senses; no servants save the muscles.

The reflex action, then, is the type of all mental operations. The brain is hidden in darkness, protected from sensation, as also from injury, by a bony box or a padding of flesh. It has no ideas of its own. It can receive no information directly. But the sense organs flood it with impressions of the external world. From the body itself, by similar means, are transmitted impulses to action. Such impulses in all animals and men are transmitted from generation to generation as a part of the legacy of heredity. They are in their nature rather methods than impulses. Movements go along lines of least resistance, and such lines are part of the stock of heredity.

Many of the impressions from environment are received by the lower nerve centers alone, the sympathetic system or the spinal cord. Here they are converted at once into motion without rising into the region of consciousness. Other sensations rise to the brain itself, and are made the basis of voluntary and conscious action. And between the purely automatic actions and those distinctly conscious and voluntary there may be found every possible intermediate grade.

Moreover, a conscious action often repeated becomes in some degree reflex and automatic. By repeated action nerve connections are formed, which have been compared to the automatic switches of the electric-light plant. By these connections an action once become familiar requires no further attention. This fact is known to us as the formation of habit. That which we do to-day voluntarily and even laboriously, the force of habit will cause us to repeat to-morrow easily, involuntarily, and whether we will or not. By the

repetition of conscious actions the character is formed. This formation of personal character by action I have called "the higher heredity," as distinguished from the true heredity which finds its bounds in the content of the germinal cell. By means of habits each creature builds up in some fashion its own life. In such way and to some degree each is "the architect of his own fortunes." In such manner "the vanished yesterdays" are the rulers of to-morrow.

Besides the actual sensations, besides the so-called realities, the brain retains also the sensations which have been, and which are not wholly lost. Memory pictures crowd the mind, mingling with pictures brought in afresh by the senses. The force of suggestion causes the mental states or conditions of one person to repeat themselves in others. Abnormal conditions of the brain itself furnish another series of feelings with which the brain must deal. Moreover, the brain is charged with impulses to action passed on from generation to generation, surviving because they are useful. With all these arises the necessity for choice as a function of the mind. The mind must neglect or suppress all sensations which it can not weave into action. The dog sees nothing that does not belong to its little world. The man in search of mushrooms "tramples down oak trees in his walks." To select the sensations that concern us is the basis of the power of attention. The suppression of undesired action is a function of the will. To find data for choice among the possible motor responses is a function of the intellect. Intellectual persistency is the essence of individual character.

As the conditions of life become more complex, it becomes necessary for action to become more carefully selected. Wisdom is the parent of virtue. Knowing what should be done logically precedes doing it. Good impulses and good intentions do not make actions safe. In the long run, action is tested not by its motives but by its results.

The child, when he comes into the world, has everything to learn. His nervous system is charged with tendencies to reaction and impulses to motion, which have their survivals from ancestral experience. Exact knowledge, by which his own actions can be made exact, must come through his own experience. The experience of others must be expressed in terms of his own before it becomes wisdom. Wisdom, as I have elsewhere said, is knowing what it is best to do next. Virtue is doing it. Doing right becomes habit if it is pursued long enough. It becomes a "second nature," or, we may say, a higher heredity. The formation of a higher heredity of wisdom and virtue, of knowing right and doing right, is the basis of character-building.

The moral character is based on knowing the best, choosing the

best, and doing the best. It can not be built up on imitation. By imitation, suggestion, and conventionality the masses are formed and controlled. To build up a man is a nobler process, demanding materials and methods of a higher order. The growth of man is the assertion of individuality. Only robust men can make history. Others may adorn it, disfigure it, or vulgarize it.

The first relation of the child to external things is expressed in this: What can I do with it? What is its relation to me? The sensation goes over into thought, the thought into action. Thus the impression of the object is built into the little universe of his mind. The object and the action it implies are closely associated. As more objects are apprehended, more complex relations arise, but the primal condition remains—What can I do with it? Sensation, thought, action—this is the natural sequence of each completed mental process. As volition passes over into action, so does science into art, knowledge into power, wisdom into virtue.

It is thus evident that, with an animal as with an army, *locomotion* demands direction. The sensorium is built up as a director of motion. Natural selection causes the survival of those whose senses are adequate for the safe control of movement. The animal which conducts its life processes in insecurity perishes. The existence of an organism is the test of its adequacy. The continued existence of a series of organisms is the ultimate proof of the truth of the senses.

With the lower animals we have automatic obedience to the demand of external conditions. The greater the stress of the environment the more perfect the automatism, for impulses to safe action must always be adequate for the duty which in the ancestral past they have had to perform. To automatic mind processes inherited from generation to generation the name instinct has been given. Whether instinct is in any degree "inherited habit" or whether it is the product simply of natural selection acting upon the varying methods of automatic response destroying those whose responses are inadequate, need not concern us now.

The homing instinct of the fur seal, concluding its long swim of three thousand miles by a return on a little island hidden in the arctic fogs, to the very spot from which it was driven by the ice six months before, excites our astonishment. But this power is not an illustration of animal intelligence. The homing instinct with the fur seal is a simple necessity of life. Without it the individual would be lost to its species. Only those which have the instinct in perfection can return; only those who return can leave descendants. As to the others, the rough sea tells no tales. We know that not all of the fur seals who set forth return. To those who do return the homing instinct has proved adequate. And this it must always be, so long

as the race exists, for general inadequacy would mean extinction of the species.

The intellect, as distinguished from lower mental operations, is the choice among responses to external conditions. Complex conditions permit a variety of responses. Varying conditions demand a change of response. This demand is met by the intellect. The intellect rises with a complex or changing environment. The greater the stress on a race of thinking creatures, the more active and effective their thoughts. The growth of man has been a succession of triumphs over hard conditions. The races which have been successful have arisen from adversity. Prosperity has been the conquest of hard times. Human progress in general has come through the falling away of the ineffective. The "fool-killer" has been its most active agent. "The goodness and the severity of God" are in science one and the same thing, as they were in the thought of the prophet. Its essence is the survival of those who can live and act effectively and happily in the conditions which surround human and animal life. The power of safe and accurate response to external conditions is the essential feature of sanity. The inability to adapt action to need is a character of insanity. Insanity, except as protected by human altruism, means death.

The difference between intellect and instinct in lower animals may be illustrated by the conduct of certain monkeys brought into relation with new experiences. At one time I had two adult monkeys, "Bob" and "Jocko," belonging to the genus *Macacus*. Neither of these possessed the egg-eating instinct. At the same time I had a baby monkey, "Mono," of the genus *Cercopithecus*. Mono had never seen an egg, but his inherited impulses bore a direct relation to feeding on eggs, as the heredity of *Macacus* taught the others how to crack nuts or to peel fruit.

To each of these monkeys I gave an egg, the first that any of them had ever seen.

The baby monkey, Mono, being of an egg-eating race, devoured his eggs by the operation of instinct. On being given the egg for the first time, he cracked it against his upper teeth, making a hole in it, sucked out all the substance, then, holding the eggshell up to the light and seeing that there was no longer anything in it, he threw it away. All this he did mechanically, automatically, and it was just as well done with the first egg he ever saw as with any other he ate. All eggs since offered him he has treated in the same way.

The monkey Bob took the egg for some kind of nut. He broke it against his upper teeth and tried to pull off the shell, when the inside ran out and fell on the ground. He looked at it for a moment in bewilderment, and then took both hands and scooped up the yolk

and the sand with which it was mixed, and swallowed it all, and then stuffed the shell itself into his mouth. This act was not instinctive. It was the work of pure reason. Evidently his race was not familiar with the use of eggs. Reason is an inefficient agent at first, a weak tool; but when it is trained it becomes an agent more valuable and more powerful than any instinct.

The monkey Jocko tried to eat the egg offered him in much the same way that Bob did, but, not liking the taste, he threw the whole thing away.

The low intelligence of the lower animals—as the fishes—may be at times worse than none at all. If mental development were a real advantage to fishes it would take place through natural selection. The fishes taken in a large pound net, as I have observed them in Lake Michigan, can not escape from it because they have not intelligence enough to find the opening through which they have entered. If, however, a loon enters the net, the fishes become frightened and “lose their heads.” In this case they will sooner or later all escape, for they cease to hunt about ineffectively for an opening, but flee automatically in straight lines, and these straight lines will in time bring them to the open door of the net.

Wild animals learn to avoid poisonous plants by instinct. Those who have not an inherited dislike for these plants perish. When the animals are brought into contact with vegetation unknown to their ancestors, this instinct fails them. Hence arises in California the danger from “loco weeds,” as certain species of wild vetches are called. These plants produce temporary or permanent insanity or paralysis of nerve centers. The native ponies avoid them, but imported animals do not, and often fall victims to their nerve-poisoning influence.

The confusion of highly perfected instinct with intellect is very common in popular science. The instinct grows weak and less accurate in its automatic obedience as the intellect becomes available in its place. Both intellect and instinct are outgrowths from the simple reflex response to external conditions. But the instinct insures a single definite response to the corresponding stimulus. The intellect has a choice of responses. In its lower stages it is vacillating and ineffective; but as its development goes on it becomes alert, and adequate to the varied conditions of life. It rises with the need for improvement. It will therefore become impossible for the complexity of life to outgrow the adequacy of man to adapt himself to its conditions.

Many animals currently believed to be of high intelligence are not so. The fur seal, just mentioned, for example, finds its way back from the long swim of two or three thousand miles through a foggy

and stormy sea, and is never too late or too early in his arrival. In like manner the female fur seal goes two hundred miles to her feeding grounds in summer, leaving the pup on the shore. After a week or two she returns to find him within a few rods of the rocks where she had left him. Both mother and young know each other by call and by odor, and neither are ever mistaken though ten thousand other pups and other mothers occupy the same rookery. But this is not intelligence. It is simply instinct, because it has no element of choice in it. Whatever its ancestors were forced to do, the fur seal does to perfection. Its instincts are perfect as clockwork, and the necessities of migration must keep them so. But if brought into new conditions it is dazed and stupid. It has no choice among different lines of action.

The Bering Sea Commission once made an experiment on the possibility of separating the young male fur seals from the old ones in the same band. The method was to drive them through a wooden chute or runway with two valvelike doors at the end. These animals can be driven like sheep, but to sort them in this way is impossible. The most experienced males will beat their noses against a closed door, if they have seen one before them pass through it. That this door had been shut, and another beside it opened, passes their comprehension. They can not choose the new direction. In like manner a male fur seal will watch the killing and skinning of his mates with perfect composure. He will sniff at their blood with languid curiosity. "So long as it is not his own it does not matter." That it may be his own in a minute or two it is beyond his power to foresee.

The study of the development of mind in animals and men gives no support to the mediæval idea of the mind as an entity apart from the organ through which it operates.

The "Clavier theory" of the mind, that the *ego* resides in the brain, playing upon the cells as a musician upon the chords of a piano, finds no warrant in fact. There is no *ego* except that which arises from the co-ordination of the nerve cells. All consciousness is "colonial consciousness," the product of co-operation. It stands related to the action of individual cells much as the content of a poem with the words or letters composing it. Its existence is a phenomenon of co-operation. The *I* in man is the expression of the co-working of the processes and impulses of the brain. The brain is made of individual cells, just as England is made of individual men. To say that England wills a certain deed, or owns a certain territory, or thinks a certain thought, is no more a figure of speech than to say that "I will," "I own," or "I think." The "England" is the expression of union of the individual wills, thoughts, and ownerships of

Englishmen. Similarly, my "*ego*" is the expression of the aggregate force co-ordination of the elements that make up my body.

The old dictum of the philosopher, "I think, therefore I am," is not literally and wholly true. "We think, therefore we are," we co-ordination of brain cells, would be quite as rational. But we brain cells do not think individually, only collectively or colonially, so no single sentence can express the whole truth, nor can a trustworthy philosophy grow out of any axiom of this sort.

The development of the character is the formation of the *ego*. It is in itself the co-ordination of the elements of heredity, the bringing into union of the warring tendencies and irrelevant impulses left us by our ancestors. The child is a mixture of imperfectly related impulses and powers. It is a mosaic of ancestral heredity. Its growth into personality is the process of bringing these elements into relation to each other.

In a remarkable study of the phenomena of "conversion," Mr. Edwin Diller Starbuck gives this view of the physiological phenomena associated with the development of personality, the building up of a *self* by a process which is primarily unselfing: "It is pretty well known," Mr. Starbuck says, "that the quality of mind is much dependent upon the fineness of nervous structure. The child has about as many nerve cells as the adult. They differ from those of the adult in form. Those of the child are mostly round, whereas those of the adult have often very many branches with which they connect with the other cells. Nervous growth seems to consist largely in the formation of new nervous connections. The rapid growth at puberty probably means that at that time there is a great increase in nervous branching. The increased ramification of nervous tissue probably determines the ability for seeing in general terms, for intellectual grasp, and for spiritual insight. The rapid formation of new nerve connections in early adolescence may be the cause of the physiological unrest and mental distress that intensifies into what we have called the sense of incompleteness which precedes conversion. The mind becomes a ferment of half-formed ideas, as the brain is a mesh of poorly organized parts. This creates uncertainty, unhappiness, dejection, and the like, because there is not the power of free mental activity. The person is restless to be born into a larger world that is dimly felt. Finally, through wholesome suggestions or normal development, order comes and the new world dawns. Often some emotional stress or shock strikes harmony into the struggling imperfection, and truth comes like a flash."

The evil effect of the excess of sense impressions and of thought dissociated from will and action has been noted many times and in

many ways. When men have made themselves wise with the lore of others, the learning which ends in self and does not spend itself on action, they have been neither virtuous nor happy. "Much learning is a weariness of the flesh." Thought without action ends in intense fatigue of the soul, the disgust with all "the sorry scheme of things entire," which is the mark of the unwholesome and insane philosophy of pessimism. This philosophy finds its condemnation in the fact that it has never yet been translated into pure and helpful life.

In like manner has sentiment not woven into action failed to be a source of effectiveness or of happiness. "If thou lovest me," said Christ to Simon Peter, then shalt thou "feed my lambs." Genuine love works itself out in self-spending, in doing something for the help or pleasure of those beloved. Religious sentimentalism, whatever form it may take, if dissociated from action, has only evil effects. Appeals to the emotions for emotion's sake have been a great factor in human deterioration. Much that has been called "degeneration" in modern social life is due to the predominance of sensory impressions over motor movement. The mind passes through a round of sensations, emotions called up by literature, music, art, religion, none of these having any direct bearing on human conduct. Their aggregate influence on the idle soul is always an evil one. And the misery of motor paralysis, of intellectual pauperism, is felt as the disease of *ennui*. The remedy for evils of reverie, *ennui*, narcotism, and the like, is to be found in action. The knowledge of this fact constitutes the strength of the Salvation Army movement. The victim of mental deterioration is given something to do. He is not to wear out the little force he has in ineffective remorse. Better let him beat a big drum and make night hideous with unmusical song than to settle down to the dry rot of reverie or the wet rot of emotional regret. Something to do, and the will to act, furnish the remedy for all forms of social discontent.

Not every sense impression needs a distinct response. It is the function of the intellect to sift these impressions, turning over into action only those in which action is desirable or wise. The power of attention is one of the most valuable attributes of the trained mind; and the essential of this power is in the suppression by the will of all impulses which do not concern the present need of action.

As the normal workings of the mind are reducible to sensation, thought, will, and action, so the abnormal workings may be due to defects of any one of these elements. We may have defects of sensation, defects of thought, vacillation of will, and inaccuracy of action. Hyperæsthesia, anæsthesia, sensory weakness, appear in the uncertain action of the muscles guided by the ill-informed brain.

The defects and diseases of the brain itself show themselves in many ways, ranging from oddity or folly to the extreme of idiocy or mania. Most of the "psychic phenomena" along "the border land of spirit," which occupy a large part in current discussions, are characters of insanity. The phenomena of hysteria, faith-cure, openness to suggestion, subjective imagery, mysticism, are not indications of spiritual strength, but of decay and disintegration of the nerves. The ecstasy of unbalanced religious excitement and a stupor of a drunken debauch may belong to the same category of mental phenomena. Both point toward moral and spiritual decay. There are no occult or "latent powers" of the mind except those which have become useless or which belong to the process of disintegration. If a man crosses his eyes, and is thus enabled to see objects double, we do not regard him as having developed a "latent power" of vision. He has simply destroyed the normal co-ordination of such powers. In like manner, one does not increase the strength of a rope by untwisting its many strands. The effectiveness of life depends upon the co-ordination and co-operation of the parts of the nervous system. Its strands must be kept together. To move in a state of reverie, "to live in two worlds at once," to be unable to separate memory pictures from realities, all these are forms of nervous disintegration. Every phase of them can be found in the madhouse. The end of such conditions is death. The healthy mind should combat all tendencies toward disintegration. It can be clean and strong only by being true.

In like manner the influence of all drugs which affect the nervous system must be in the direction of disintegration. The healthy mind stands in clear and normal relations with Nature. It feels pain as pain. It feels action as pleasure. The drug which conceals pain or gives false pleasure when pleasure does not exist, forces a lie upon the nervous system. The drug which disposes to reverie rather than to work, which makes us feel well when we are not well, destroys the sanity of life. All stimulants, narcotics, tonics, which affect the nervous system in whatever way, reduce the truthfulness of sensation, thought, and action. Toward insanity all such influences lead; and their effect, slight though it be, is of the same nature as mania. The man who would see clearly, think truthfully, and act effectively, must avoid them all. Emergency aside, he can not safely force upon his nervous system even the smallest falsehood. And here lies the one great unanswerable argument for total abstinence; not abstinence from alcohol alone, but from all nerve poisons and emotional excesses. The man who would be sane must avoid all nerve excitants, nerve soothers, and "nerve foods," as well as trances, ecstasies, and similar influences. If he would keep his

mind he must never "lose his head" save in the rest of normal sleep.

No great work was ever accomplished under the influence of drugs or stimulants. The great thoughts and great works which have moved the world came from men who have lived pure, sober lives. These were men whose nervous systems were truthful as the stars, and the great truths of the universe they could carry over into action.

What is true of man is true of animals, and true of nations as well; for a nation is an aggregation of many men as a man is a coalition of many cells. In the life of a nation, Lowell tells us, "three roots bear up Dominion—Knowledge, Will, the third Obedience, the great tap-root of all." This corresponds to the nervous sequence in the individual. And as in general the ills of humanity are due to untruthfulness in thought and action, so are the collective ills of nations due to national folly, vacillation, and disobedience. The laws of national greatness are extensions of the laws which govern the growth of the single cell.

SCHOOL GARDENS.

BY HENRY LINCOLN CLAPP.

IN cities where Nature study has been introduced, it has become evident that the required number of plants suitable for the purpose of instruction in the elements of botany is obtained often with considerable difficulty. A school in the suburbs, with woods and fields near, and a free range for its pupils, in a few years finds the open places occupied with houses and notices to trespassers, and the sources of material for observation work cut off. In the public parks are posted notices forbidding the plucking of a leaf or the breaking of a twig. There is plant material enough for study everywhere, even in a city, but it is not available for schools.

School grounds are generally given up to play or gymnastic exercises. Only a few educators in this country have thought of them as sources for obtaining plant material for observation work. In many places in Europe school grounds are very much better managed than in this country. Not only do school authorities there aim to supply materials for study in the schoolroom, but they mean to impart clear ideas of horticulture and related occupations by various uses of land connected with the schools. They appreciate the training which results from pruning, budding, and grafting trees, plowing, hoeing, and fertilizing land, hiving bees, and raising silkworms.

In 1890 there were nearly eight thousand school gardens—gardens for practical instruction in rearing trees, vegetables, and fruits—in Austria. The Austrian public-school law reads: "In every school a gymnastic ground, a garden for the teacher, according to the circumstances of the community, and a place for the purposes of agricultural experiment are to be created. School inspectors must see to it that, in the country schools, school gardens shall be provided for corresponding agricultural instruction in all that relates to the soil, and that the teacher shall make himself skillful in such instruction. Instruction in natural history is indispensable to suitably established school gardens. The teachers, then, must be in a condition to conduct them."

In France gardening is practically taught in twenty-eight thousand primary and elementary schools, each of which has a garden attached to it, and is under the care of a master capable of imparting a knowledge of the first principles of horticulture. No one can be appointed master of an elementary school unless qualified to give practical instruction in cultivating the ordinary products of the garden.

In Sweden, as long ago as 1871, twenty-two thousand children received instruction in horticulture and tree planting, and each of two thousand and sixteen schools had for cultivation a piece of land varying from one to twelve acres.

Still more significant is the recent establishment of many school gardens in southern Russia. In one province two hundred and twenty-seven schools out of a total of five hundred and four have school gardens whose whole area is two hundred and eighty-three acres. In 1895 these gardens contained one hundred and eleven thousand fruit trees and two hundred and thirty-eight thousand three hundred planted forest trees. In them the schoolmasters teach tree, vine, grain, garden, silkworm, and bee culture. They are supported by small grants of money from the country and district councils. In the villages, small orchards and kitchen gardens are connected with many primary schools. This movement has also widely spread over different provinces of central Russia.

If the establishment of school gardens in the country is a wise step, the advantages of such gardens in cities should be apparent at once.

Since 1877 every public school in Berlin, Prussia, has been regularly supplied with plants for study every week, elementary schools receiving specimens of four different species and secondary schools six. During the summer, at six o'clock in the morning, two large wagons start from the school gardens, loaded with cuttings packed and labeled for the different schools. The daily papers

regularly announce what plants may be expected, and teachers consult with the gardeners as to what ought to be sown or planted. Teachers take their classes into the school gardens for lessons in botany, and are aided by the gardeners, who cut the specimens.

The gardens in Berlin are few in number, and lack many advantages to be found in the country gardens. Comparatively few pupils can see the plants growing from seed to seed, or growing at all. The butterflies, beetles, and other insects which are constantly



HEPATICA TRILOBA. George Putnam School Garden.

at work on growing plants come to the notice of only a few children, consequently their habits can not be known to many. The nature of annuals and biennials, the growth of plants from week to week, the results of varying conditions of soil, light, heat, and moisture, which are so necessary to a broad and sound understanding of plant growth, can not be properly understood if reliance is to be placed on cut specimens alone. With cut specimens there are cut off more than half of the advantages to be found in the study of plants growing under favorable conditions.

Such considerations lead to the conclusion that every school should have its own garden, where the opening and closing of blossoms, the springing and unclosing crosiers of ferns, the clinging tendrils and rootlets of various vines, and numerous other habits of growth may be observed at the right time.

In March, 1890, a paper entitled Horticultural Education for

Children was read in Boston before the Massachusetts Horticultural Society by one of its members. The interest aroused by the reading of this paper resulted in the establishment of a school garden in connection with one of the Boston grammar schools in the spring of 1891. A committee of the society promised such pecuniary support as seemed to be needed from time to time. Mrs. Henrietta L. T. Wolcott, then at the head of the committee, in presenting the claims of school-garden work to the society, said: "We desire to emphasize the true idea of a school garden. Growing plants, from the first sign of germination to the full perfection of blossom and fruit, and edible roots in all stages, give constant opportunity for study. We believe that by means of the school garden children can be so trained to appreciate plants growing naturally that the present custom of laying out public gardens with flowering and foliage plants arranged in the form of grotesque designs, portraits of distinguished men, symbols of trades, spiritual suggestions or emblems, and rolls of carpeting framed and left out in rain and sunshine will in time disappear. Setting rows of plants in military precision and replacing them by others like magic can have but little educational value."

Since the committee intended to offer premiums for the best school gardens, they thought that persons might be induced to buy the ordinary cultivated plants of a florist, and with them make what they might choose to call school gardens. This, however, would not imply any proper knowledge of such plants, or more useful ones, nor ability to make good use of them as objects for study. It was thought that troubles might arise from allowing a florist's garden to be taken as the standard for the gardens which they wished to see established. The one who spent the most money, or had the most persuasiveness among florists, might establish fine gardens, lay claim to premiums in good faith, and win them; and yet such gardens might not serve the purpose which the committee considered best. Accordingly, they decided that in the beginning only those plants which were the most suitable for educational purposes should form the main stock of the school gardens. The decision was expressed thus: "Ornamental plants, or those commonly cultivated in flower gardens, will not stock the school gardens contemplated by the committee. Native wild plants, such as ferns, grasses, asters, golden-rods, violets, native shrubs, and economic plants, such as grains, vegetable roots, and leguminous and cucurbitaceous plants, must be the stock of the gardens."

Later, when children's natural love for color and the influence of beautiful flowers in the schoolroom in cultivating æsthetic tastes came to be considered, cultivated plants were allowed introduction,

but in a secondary place. It was claimed with truth that teachers who have beautiful flowers on their desks, and fine bits of color on the walls of their rooms, were likely to have other matters in harmony, order, neatness, quietness, and an atmosphere conducive to study. The flowers seem to set the key, and other matters are tuned up to that pitch. Pupils appreciate the conditions and the teacher. Unscholarly conduct is felt to be a discordant note, and the sentiment of the class is against it. However, the committee



ASTER CORDIFOLIUS. George Putnam School Garden.

had other and perhaps higher aims to accomplish. They wished pupils to take a positive, conscious part in the development of plant life.

In accordance with the conditions mentioned, the committee decided to start a garden where the circumstances seemed most favorable, and appropriated ten dollars for the purpose. A piece of ground forty-eight by seventy-two feet in the back of the boys' yard of the George Putnam Grammar School was found the most available, and a few teachers in the school offered all the assistance in their power to carry out the purposes of the committee.

The soil was such as one might expect to find where no thought of plants or plant materials for a moment entered the minds of those

who were instrumental in the establishment of the school and the preparation of the course of study.

The pupils brought in many wild plants, and the fleshy roots of biennials—turnips in variety, carrot, parsnip, radish, beet, onion (bulb), cabbage, etc. In planting, they took turns in digging the holes and placing the plants in position. Observations were made during the flowering season. The structure of the flowers of the cruciferous and umbelliferous plants was studied, and the nature of biennials was revealed. Other economic plants, such as the potato, the tomato, and the gourd, were raised to show the individualism of plants.

A square yard of ground was assigned to each of the ordinary grains—wheat, rye, oats, barley, and buckwheat. The first four, being most important members of the grass family, were especially interesting in their development. After that, grains meant more to the pupils.

Nineteen species of wild asters were planted in one row. Ten of the finest flowering kinds formed another row. Later it was discovered that those plants blossomed the most profusely which sprang from seeds scattered at random around trees and beside rocks and fences.

In the fall, seed vessels were collected for study in winter, and bulbs, corms, and tubers were stored away for spring planting.

Each member of the highest class had a particular plant to take care of and study. He dug around and watered it, took off all dead leaves and unseemly branches, and tied it up. Then he sketched its characteristic parts—flower, leaf, stem, habit of growth, etc.—and took such written notes as would enable him to write an account of his plant and illustrate it with appropriate drawings. On one occasion each of the thirty-two members of the class studied his own clump of asters, there being just clumps enough to go around. The importance of seeing and studying plants growing in large masses is not likely to be overestimated if interest and thoroughness in learning about them are desired. Comparatively, a single cut specimen in hand means but little.

By the aid of the boys a fernery was made in an angle of the school building on the north side, in a shady, sheltered position. They took handcarts into the woods half a mile distant and collected leaf-mold, which they mixed up thoroughly with loam and sand, and then assisted in taking the ferns from scattered places in the garden and locating them by genera in the fernery. The name of each species was written on a flat stick, which was stuck into the ground near the specimen to which the name belonged.

Seeing what one teacher had done, another, by means of a

hand camera, made a series of lantern slides, which proved to be of the greatest service for class instruction during the following winter. A solar camera and a twelve-foot screen completed the



A CORNER OF THE FERNERY. George Putnam School Garden.

equipment for the most interesting and profitable kind of instruction on the subject of ferns.

The pupils of one class studied fifteen species somewhat minutely by means of the slides and pressed specimens. Spores, sporangia, indusia, sori, pinnules, pinnæ, rachis, stipe, general shapes, textures, and relative position of parts were carefully observed, drawn, described, and colored. Notebooks contained characteristic parts of all the different species, which were broken up and distributed for the purpose. This study prepared the pupils to appreciate the development of fern crociers in the fernery in the following spring. Twenty-two pupils out of the class of thirty-eight introduced ferns into their own gardens at home.

Other classes studied composite flowers, distribution of seeds, roots, corms, tubers, bulbs, and other material supplied by the garden.

In the spring of 1895 the development of fern crociers was studied with great interest by the pupils. The collection of lantern slides soon included representations of the crociers of the principal species in various stages of growth. In some respects the pictures

of the crosiers served a more useful purpose than the crosiers themselves, because their representations on the screen were very large, and could be seen very easily by the whole class at once.

At present there are more than one hundred and fifty different species of native wild plants in the garden. No attempt has been made to arrange them in ornamental beds, since they can not be studied so well in that arrangement. When over fifty pupils at a time are to study growing plants, such plants must be easily accessible, and therefore scattered as much as is consistent with other con-



FOURTH-GRADE PUPILS OBSERVING. George Putnam School Garden.

ditions, especially that of caring for the plants and mowing the grass about them. Three or four times as many children can examine twenty plants set in rows as can examine them arranged in a bed; and the work of weeding the plants and cutting the grass in the former arrangement is not half as much as in the latter. The useful arrangement always takes precedence of the ornamental.

A great many insects have been observed upon the plants—beetles, wasps, flies, moths, and butterflies. In the last class nine species have been seen: *Pieris rapae*, *Colias philodice*, *Melitæa pharos*, *Cynthia Atalanta*, *Grapta interrogationis*, *Cynthia cardui*, *Danaïs Archippus*, *Papilio turnus*, and *Lycæna americana*. Soon

the garden will afford the pupils their only opportunities for studying, describing, drawing, and painting such insects.

How the garden is supported, and how the necessary work is done, are interesting questions to those who think of starting a garden. Since 1891 the Massachusetts Horticultural Society has offered every year a premium of fifteen dollars for the best school garden, in connection with the best use of it. This garden has competed with others, and won the premium every year. Five dollars pays for the annual enrichment of the soil, and ten dollars for the labor of the janitor, who, during the long summer vacation, weeds, hoes, and waters the plants, and cuts the grass periodically. In spring he wheels in and spreads fertilizing material, prepares new beds or rows, and resets old ones with plants changed from other localities. During the school season in spring and autumn teachers and pupils do considerable work in weeding and transplanting; the former being able to distinguish choice plants, however small, from weeds, which many a so-called good gardener is frequently unable to do.

Reasons that are good for introducing the elements of science into elementary schools are equally good for supplying adequate and seasonable elementary science material to work upon. Plants are so available for the purposes of instruction, their structure, uses, and functions are so varied and interesting, that it is generally conceded that the best elementary science material on the whole is found in the vegetable world.

The repulsion that is so often felt in studying animals or animal physiology is unknown in studying plants, and the cycle of plant life from seed to seed furnishes a lesson in biology that is unsurpassed in value. Moreover, living plants, out of doors, are necessarily connected with mineral forms—air, earth, and water—as well as with various forms of animal life—butterflies, moths, beetles, wasps, ants, grubs, and worms—all together furnishing constant illustrations of correlation under the best conditions.

The elements of zoölogy may be studied in the schoolroom with some profit by means of dried and alcoholic specimens, skeletons, diagrams, and books, but visible correlation will of necessity be wholly left out. The same may be said of mineralogy or mineral substances generally. But in the school garden the interdependence of animals, plants, and minerals is always obvious, and teachers and pupils can take advantage of it without taking time and money to go to the country for the purpose of seeing the three kingdoms of Nature properly related. Of course, the excursion is better in many respects, since many instructive things may be seen which are not possible for a school garden; but the excursion at best is seldom practicable. On the school premises, pupils are

much more amenable to control and instruction than on an excursion. Without the school garden the great masses of children in cities will never have their attention directed to the great lessons of Nature in any telling way. Some of them may visit the country, but very few will have efficient direction, and the results will be meager.

It is too much to expect that teachers, especially those in city schools, will unremittingly supply fresh material whenever needed for instruction in the elements of science. Even in the country the



CHILDREN WORKING IN GEORGE PUTNAM SCHOOL GARDEN.

most desirable plants are often far from the school. It would be a most extraordinary school district where fourteen golden-rods, eighteen wild asters, and twenty-nine ferns, all different kinds, might be found growing. Probably half of the plants that would flourish in a school garden could not be found in the district at all; or, if they could, they would be scattered and remote from the school, and whether they were in a proper state of development for study could not always be ascertained easily. The nearness of the school garden is one of its most valuable features.

A book might be written on the educational value of a school garden properly used; but mention of its main advantages must suffice. Besides the opportunity for correlation, previously mentioned, it gives the opportunity for bringing together a great number of plants to be classified and arranged in families, genera, and species.

The reason for such classification becomes apparent in the grouping of plants similar in form, structure, and habits; and the comparison of many such plants impresses on the child's mind the characteristics of families, genera, and species in the most forcible manner. What cultivation will do by way of increasing the vigor of plants and making them blossom and fruit more freely is fully illustrated every season. Pupils learn that they can be instrumental in starting the wonderful development of plants. They learn how Nature provides for the continuance of species by storing up food in seeds, roots, and fruit, and protecting delicate organs by impervious gums, imbricated coverings, and woolly packings. Lessons in human economy are learned from the study of vegetable economy. The mutual dependence of insects and plants is seen to be characteristic of mutual dependence in the world at large.

The school garden affords by far the best means for the cultivation of the powers of observation. Pupils find excellent forms to draw, colors to imitate, habits to describe, and motives to use in decorative design. They find something to take care of, something that quickly responds to love's labor, and as interest is added to interest they lay up for themselves resources for happiness that should be the heritage of every child, even the poorest city child; and this would be so if school authorities and the people behind them had more real insight into children's best natures, more foresight, more humanity, and more liberality in the purchase and equipment of school grounds.

To spend large sums of money on architectural beauties and stone carvings of historic ornaments—which have but little attraction for children—to make a school building look like a palace, and then to leave the school yard looking like a desert or the top of a bituminous lake, without a single attractive flower or one bit of beauty, are inconsistencies which seem possible only in the modern system of education. Weather-beaten houses in the country, log cabins on the frontiers, railroad stations in the "Great American Desert" and all over our country have their beautiful flower gardens, and it refreshes one's soul to see them; but there is no such source of refreshment, inspiration, and instruction where children are being educated in the "essentials."

Once in a while some discerning man, outside of the regular school interests, sees the inconsistency of educational systems, and gives expression to his thoughts on the subject, as Lowell did in his letter to a student, and as Hamilton W. Mabie has done in his *Essays on Nature and Culture*. Mr. Mabie says: "Relationship with Nature is a resource of inexhaustible delight and enrichment; to establish it ought to be as much a part of every education as the

teaching of the rudiments of formal knowledge; and it ought to be as great a reproach to a man not to be able to read the open pages of the world about him as not to be able to read the open page of the book before him."

If *littérateurs* have reasons to think and talk in that way about existing educational conditions, how should school men, who profess to study school problems and the highest interests of children, be affected by similar conditions—and what should those who appropriate money for school purposes do to establish proper relationship between school children and Nature? The most promising thing would be to establish school gardens, and see that teachers should be in suitable condition educationally to make the best use of them.

The great enrichments in the educational system of Sweden are gymnastics, sloyd, and school gardens. We have adopted the first two, and they have proved to be very helpful in our system of education; now let us adopt the last and best, and line up with France, Austria, and Russia in establishing school gardens as an essential means of educating children properly.

THE UNITED STATES FOREST RESERVES.

By HON. CHARLES D. WALCOTT,
DIRECTOR, UNITED STATES GEOLOGICAL SURVEY.

HISTORICAL.—The movement in favor of Government forest reserves in the United States began soon after it became apparent that unless some restriction was placed upon the wasteful cutting and destruction of the forests of the continent the timber supply would soon be exhausted. The country would then become dependent upon other nations for its timber supply, and would suffer as do many European states, where great efforts have been made during the last thirty years to restore the forests which had been so wantonly destroyed. One of the most influential agencies in bringing about the establishment of the forest reserves was the agitation carried on by the American Forestry Association and the Division of Forestry of the Department of Agriculture, under the leadership of Dr. B. E. Fernow. The many reports and essays published and lectures delivered had a strong influence in creating a public sentiment that at last manifested itself in the passage, on March 3, 1891, of an act granting authority to the President to set aside as public reservations public lands bearing forests, wholly or in part covered with timber or undergrowth. (Statutes at Large., vol. xxvi, p. 1103, sec. 24.)

Under this act seventeen forest reservations were established prior to September 28, 1893, aggregating in area 17,564,800 acres.

These are: The Pacific Reserve (967,680 acres) of Washington; the Cascade (4,492,800 acres), Bull Run (142,080 acres), and Ashland (18,560 acres) Reserves of Oregon; the Sierra (4,096,000 acres), San Gabriel (555,520 acres), San Bernardino (18,560 acres), and Tra-buco Cañon (49,920 acres) Reserves of California; the Yellowstone Park Reserve (1,239,040 acres) of Wyoming; the South Platte (683,520 acres), Plum Creek (179,200 acres), White River (1,198,080 acres), Battlement Mesa (858,240 acres), and Pike's Peak (184,320 acres) Reserves of Colorado; the Grand Cañon (1,851,520 acres) Reserve of Arizona; the Pecos River (311,040 acres) Reserve of New Mexico, and the Afognak Reserve (area unknown) of Alaska.

The establishment of these reserves did not excite any special approval or disapproval of the policy, except as some local interest was affected favorably or unfavorably. In the latter case little attention was paid to it by the parties directly concerned, as there was no real protection of the reserves or public forests by patrol, and the cutting of timber and destruction by fires went on as before. It was not until the executive proclamations of February 22, 1897, were made that great opposition was developed in the Northwestern States, in which many of the reserves were situated. These proclamations, based upon the recommendation of the Forestry Commission of the National Academy of Sciences, established thirteen forest reservations, containing an aggregate area of 21,379,840 acres. Their names, locations, areas, etc., are given in the following table:

NAME OF FOREST RESERVE.	Location.	Estimated area (acres).	Object.
Black Hills.....	The central portion of the Black Hills, of South Dakota.	967,680	To protect and make permanently productive this isolated forest, which is essential to adjacent mining and farming interests.
Big Horn.....	Slopes of the Big Horn Mountains in northern central Wyoming.	1,127,680	To protect the water supply of streams important to farming in adjacent regions.
Teton.....	Adjacent to and south of the Yellowstone Park timber reserve.	829,440	To protect the water supply of streams important to farming in adjacent regions.
Flathead.....	Slopes of the Rocky Mountains, Montana, from the Great Northern Railroad to the international boundary.	1,382,400	On the eastern slope to make the forests permanently productive for mining, and to protect the headwaters of tributaries of the Missouri. On the western slope, to protect cultivated valleys from floods.
Lewis and Clark.	Both slopes of the continental divide in Montana, from near the line of the Great Northern Railroad southward nearly to the forty-seventh degree of latitude.	2,926,080	To protect the sources of the Missouri essential to irrigation, to prevent floods, and to preserve the forest for intelligent development of its values.

NAME OF FOREST RESERVE.	Location.	Estimated area (acres).	Object.
Priest River	Priest Lake and Priest River basin in Idaho and Washington, from the Great Northern Railroad to the international boundary.	645,120	To preserve the timber for future supply and for development of a productive timber reserve.
Bitter Root	The Bitter Root Mountains in Montana and Idaho.	4,147,200	To protect the sources of streams important to irrigation in Montana, Idaho, and Washington; to preserve valuable timber and to restore burned forests.
Washington	The Cascade Range from south of the forty-eighth parallel to the international boundary, excepting the settled Skagit Valley.	3,594,240	To prevent destruction by fire, to protect the sources of rivers flowing eastward for irrigation, and to render permanent the timber resources of the western slope.
Olympic	The Olympic Mountains.	2,188,800	To make a permanent and profitable reserve of the finest body of timber in the United States.
Mount Rainier . . .	The former Pacific Forest Reserve and an extension southward nearly to the Columbia River along the Cascade Range.	2,234,880	To protect the tributaries of the Yakima requisite for irrigation, and to preserve the forest wealth of the State in this region.
Stanislaus	Sierra Nevada in California.	691,200	For protection of water supply for irrigation.
San Jacinto	San Jacinto Mountains south of the San Bernardino Reserve.	737,280	For protection of water supply for irrigation.
Uinta	Uinta Mountains, exclusive of the Indian reservation.	875,520	For protection of water supply for irrigation and development of the forest for local timber supply.

In the letter recommending the establishment of the reserves, the Forestry Commission stated that it fully recognized the fact that the forest reserves previously established and now proposed can not be maintained unless a plan is adopted under which their boundaries shall be so modified as to take from them all land better suited for agriculture than for the production of forests, and under which their timber can be made available for domestic, mining, and commercial purposes, and valuable minerals can be freely sought and mined within their boundaries. The commission also stated that it believed that the solution of this difficult problem would be made easier if the reserve areas were increased, as the greater the number of people interested in drawing supplies from the reserved territories, or in mining in them, the greater would be the demand on Congress for the enactment of laws securing their proper administration. "For this reason," said the commission, "it is the unanimous opinion of the commission that the establishment by proclamation of the reserves described above is now a matter of the

utmost importance to the development and welfare of the whole country."

The result of establishing the reserves more than met the anticipations of the commission that legislation would follow, owing to the pressure of the people on their representatives in Congress. The first storm of protest came mainly from South Dakota, Wyoming, Montana, and Washington. Public meetings were held at which vigorous speeches were made in opposition to the forest-reserve policy, and soon a flood of petitions and letters reached the senators and representatives from the States mentioned, and those from adjoining States in which reserves are situated or which are dependent upon the reserves for their timber supply. Early in March an amendment was incorporated in the Sundry Civil Bill in the Senate revoking the forest-reserve proclamations of February 22, 1897. This, however, was modified in conference with the House so as to authorize the President to suspend or revoke the proclamations if he thought fit to do so. The bill failed, and when the new Congress assembled, on March 15, the agitation against the reserves was resumed.

A long debate in the Senate was followed by the final passage of an extended amendment providing for the suspension of the reserves established by the proclamations of February 22, 1897, until March 1, 1898, and providing further for the survey of the forest reserves, under the supervision of the Director of the Geological Survey, and appropriating one hundred and fifty thousand dollars for the purpose. Provision was made that "a copy of every topographic map and other maps showing the distribution of the forests, together with such field notes as may be taken relating thereto, shall be certified thereto by the Director of the Geological Survey, and filed in the General Land Office"; the object of this being to place before the department the data upon which to recommend the location of the boundaries of the forest reserves, authority being given to the President in the amendment "to revoke, modify, or suspend any or all of such executive orders and proclamations, or any part thereof, from time to time as he shall deem best for the public interests."

In addition to the provisions for the survey and modification of the reserves, most important legislation for their future preservation, control, and administration was embodied in the act. It is provided that "the Secretary of the Interior shall make provision for protection against destruction by fire and depredations upon the public forests and forest reservations, and that he may make such rules and regulations, and establish such service as will insure the objects of such reservations, namely, to regulate their occupancy and use, and to preserve the forests thereon from destruction."

Provision is also made for the cutting and sale of the timber and the carrying on of mining and irrigation enterprises within the reserves, under permits to be granted and regulations to be established by the Secretary of the Interior. Essentially all the authority recommended in the final report of the Forestry Commission of the National Academy of Sciences is given by this legislation, with the exception of authority to employ troops in policing the reserves. The wording of the amendment is broad, and leaves the manner of establishing the administration and protection of the reserves in the control of the Secretary of the Interior. As soon as the surveys are completed, and the boundaries of the reserves determined, the final establishment of a rational forestry policy can be entered upon. Meantime, a beginning has been made through the authority granted by the act appropriating money for the protection of timber on public lands.

SURVEYS.—The forest-reserve legislation was enacted June 4, 1897, and arrangements were at once made for the topographic and subdivisional surveys of those portions of the suspended reserves in which there are large interests that may be injuriously affected if those areas are included within the reserves; for instance, the agricultural and mining interests of portions of the Black Hills Reserve of South Dakota, the mining interests of the southwestern portion of the Washington Reserve of Washington, and the timber interests of the eastern portion of the Bitter Root Reserve in Montana.

The topographic surveying parties were organized and left Washington the latter part of June. The purposes of the topographic surveys are (a) the preparation of topographic maps, on a scale of two miles to the inch, with contour intervals of one hundred feet, as base maps for the representation of forestry details, agricultural and mineral lands, and future geologic surveys; (b) the establishment of bench marks indicating elevation above sea level, for vertical control in topographic mapping, and for all mining, engineering, and geologic work; (c) the subdivision of reserves, where necessary, by running township lines for the purpose of designating tracts of land; (d) the demarcation by means of section lines of tracts which are more valuable as agricultural and mineral lands than for timber; and (e) the mapping by the topographer in charge of each party of the outlines of all wooded and forest areas.

Early in July the forestry survey was organized, and soon thereafter the special forest experts began the study of the distribution of the forests and woodlands, the size and density of the timber, the distribution of the leading economic species, the effect of the ravages of forest fires and the amount of damage inflicted by them, the amount of dead timber, the extent to which the forests are pastured,

and the extent of the timber already cut and the effects of the deforesting; also the relation of the timber supply to transportation, local demands of miners and settlers, and the supply needed for more distant markets.

The examinations of the surveyors and forestry experts are not limited to the present lines of the forest reserves, but, as provided for in the statute authorizing the survey, they include public lands adjacent to the reserves.

It is anticipated that the sixty thousand square miles of forests now included within the reserves can be thoroughly and economically surveyed within five years, provided adequate appropriations are made for the purpose. Nearly enough if not sufficient data for the construction of topographic and forestry maps have been secured during the past field season to permit of an intelligent rectification of the boundaries of most of the reserves containing areas where apparent injury or injustice is being inflicted by the establishment of the reserves.

The progress of the surveys during the short field season was slow, as the reserves comprise some of the most rugged mountain country in the West, much of which is covered with forests. No maps existed of the larger portion of the reserves. The surveys for the topographic and forestry maps of the Black Hills Reserve were completed, and for a considerable portion of the Big Horn Reserve. The forests were examined and the data platted, on Land Office and sketch maps, for the unsurveyed areas of the other suspended reserves, and a large body of information was secured in relation to the extent and character of the forests except on the Olympic Reserve.

The examination of the Priest River and Teton Reserves has been quite thorough, as well as that portion of the Bitter Root Reserve lying in Montana. The Washington Reserve has received the most careful examination in relation to its forest condition, although the topographic mapping and triangulation have been limited to the eastern and western sides of the divide of the Cascade Range. Triangulation has been initiated and extended over most of the Lewis and Clark and Flathead Reserves in Montana, and in the Uinta Reserve triangulation has been carried forward upon the small area mapped.

Late in October and November the surveying parties were withdrawn from the Northern States, owing to the severe weather, and several of them were transferred to southern California, where they are working in the San Gabriel and San Jacinto Reserves.

COST AND PROFIT OF FOREST RESERVES.—Will it pay to maintain Government forest reserves? This question is best answered by referring to what has been done in other countries. The published

statements show that the annual receipts of the forest administration of Prussia are about \$14,000,000, and the expenses about \$8,000,000, leaving a net revenue to the Government of about \$6,000,000. The annual revenue from the Government forests of France and Algiers exceeds \$6,000,000, and the expenses for 1896 were estimated at \$3,300,000. The net revenue of the great forest areas of British India for 1894-'95 was 7,415,590 rupees, or about \$3,000,000. In British India the varied climate and the difficult silvicultural conditions are similar to those found within the forest reserves and public forested lands of the United States. The total area of forest land under the control of the forest service of India in 1894-'95 was 112,952 square miles, of which 74,271 square miles were reserved forests, 7,090 protected forests, and 31,591 unclassed state forests. The total length of boundaries demarcated to June 30, 1895, in provinces under the Government of India alone was upward of 60,000 miles, and an area of 33,420 square miles is covered by topographic surveys. In a territory of 30,963 square miles, fires are kept in check, and 28,913 square miles are fully protected at a cost of about \$2.60 per square mile, or less than one half cent per acre per annum.

The area administered by the forest service yielded, during the year 1894-'95, 46,000,000 cubic feet of timber, 100,000,000 cubic feet of fuel, 134,000,000 bamboos, and minor products to the value or 3,000,000 rupees or more. In this connection it should be borne in mind that systematic Government forestry in India is of recent growth. The first act was passed in 1865, although the management of the teak forests of Pegu was inaugurated some ten years before.

In Canada, where the physical and topographic conditions greatly resemble our own, the management of the Government forests devolves upon the department of Crown Lands, with an administrative bureau which is charged with public instruction in forestry as well as the supervision of the forested districts. The administration is under the charge of officers denominated Crown Lands and Timber Agents, having under them experienced woodmen called forest rangers, fire rangers, etc.

The total revenue from lumbering operations in the province of Quebec for the year ending June 30, 1896, amounted to \$951,098.92. In Ontario the forested territory is divided into timber "berths" of different sizes, which are sold at auction to the highest bidder. At the last sale, in 1892, an average price was paid of \$3,657.18 per square mile, subject to stumpage dues. The land is not sold, but is reserved for settlers, the person who has bought the right to cut the timber retaining the control of the land until it is required for settlement.

The cost of a permanent forest organization for the protection and utilization of the forests on the reserves is estimated by the National Forestry Commission at \$250,000 per annum for the first five years. With a greater demand for forest supplies the annual expense will increase, but under any businesslike management the revenue from the sale of forest products will largely exceed the expense, yielding a handsome surplus to the Government. "When it is remembered that several million dollars' worth of timber are taken every year from the public domain without any recompense to the Government, it would appear to be a wise and economical policy to spend annually a few hundred thousand dollars on an organization which would prevent such unnecessary drains on the wealth of the nation; it must be remembered also that an efficient forest administration would be able to prevent many forest fires on the public domain, and that it is not an unusual occurrence for a single fire to destroy in a few days material worth more in actual money than this forest administration would cost in years, while the indirect loss to the country in impaired water flow is incalculable. The expenditure, therefore, of \$250,000 a year in furnishing the means for protecting the forests on the public domain would appear to be justified by every consideration of common sense and economy." (Report of National Forestry Commission, p. 26.)

The experience of British India and Canada proves conclusively that Government control of the forests can be made profitable both to the Government and to the people using the forest products.

PROTECTION AGAINST FIRE.—The Ontario system provides for fire rangers, who are authorized to employ assistants to help suppress fires, and they are directed to notify the department if the fires are dangerous. The expense incurred in maintaining the forest staff and suppressing fires is shared between the Crown Lands Department and the owners of the licenses to cut timber. During the summer of 1895, ninety-three fires were reported, most of which were put out, the total loss by fire being only \$41,600. This was effected by the employment of one hundred and fourteen men for a few months, at a total cost of \$26,253.

The districts of upper and lower Ottawa during the summer of 1895, when it was unusually dry, experienced no serious conflagrations. No fewer than fifty-six incipient fires, however, were extinguished by the fire rangers, any one of which might have assumed serious proportions and caused heavy loss. The total loss in the district amounted to between five hundred and one thousand dollars.

In other districts in Quebec numerous small fires are extinguished every year by the forest rangers, which action prevents the destruction of thousands of acres of forests.

The forests of the western provinces of the Dominion are under the control of the Minister of the Interior, who follows the system adopted in the older provinces.

Within the forested areas of the United States the most destructive agent at present is fire. In comparison with it the damage done by pasturage in the Pacific coast States and by illegal timber cutting is insignificant. In a number of the Western States laws have been passed providing for the punishment of those who, by accident or design, set fire to the forests. There are so many agencies, however, by which fires may be started, such as sparks from locomotives, camp fires, lightning, as well as incendiarism, that it seems futile to attempt to prevent the burning of the forests unless there are competent forest guards to patrol them during the dry season.

There are no statistics showing the area of forests destroyed annually by fires in the United States, but during every summer smoke obscures for months the view of the sun over thousands of square miles. Once fully under way, a fire in a forest of coniferous trees will spread until it is extinguished by rain, or encounters some natural barrier like a river, or is driven back over its own course by a change in the direction of the wind. The only hope of averting the enormous losses which the country suffers every year from this cause lies in preventing the fires from starting, or in extinguishing them promptly. There is no doubt that they will always occur, but the experience gained in the Yellowstone National Park, and in Canada shows conclusively that with the aid of a disciplined forest patrol, intelligently directed, forest fires can be greatly reduced, and that it is frequently possible to extinguish small fires if properly handled when first discovered.

MINING INTERESTS.—The mining interests of the Western States should be the most urgent in the demand for care and protection of the forests under Government direction. Upon the abundance or scarcity of timber will depend the development of many mining enterprises, and through them the advance or retardation of the growth of the State in which they are situated. That scarcity of timber will limit mining is without question, unless the mines are sufficiently rich to pay the added cost that transportation from a distant source of supply will entail. This will apply particularly to the small mine owner, and to the miner with little capital who wishes to develop promising prospects.

There is no doubt that the abundant timber supply of the Black Hills of South Dakota has given great impetus to the development of the mineral wealth of the region. It is equally true that if that timber supply is removed by being wasted, or is destroyed by forest fires, the future mining of the region will be limited to the working

of a few rich mines that can afford to pay high prices. Scarcity of timber all over the West is not a remote contingency if the present waste and destruction are permitted to continue; it is already in sight. Indeed, it will not be long before the magnificent forests of the Pacific coast will be so greatly injured by fire and wasteful cutting that the mining communities will have to draw their best timber from Canada and Alaska.

The opponents of the forest reserves have frequently stated that the reservation policy would cripple the mining industry. It is believed, however, that there would be much more truth in the statement that the destruction of the forests would seriously injure and in many instances ruin the mining industry. This industry demands a permanent source of supply of timber, and it hardly needs to be said that, without some such policy as that of forest reservation, no such source of supply can be maintained. If mining men can be brought to understand that their industry will be protected by the proper administration of the reserves, the future of both the mining and the lumber interests of the West will be provided for.

IRRIGATION INTERESTS.—A great industry like that of agriculture demands that in all regions where irrigation is carried on the source of the water supply be protected. The future existence of the farms, and to a large extent of the States themselves, depends upon the conservation of the water supply. The forest areas are largely the reservoirs in which the waters are controlled and given out to the adjacent irrigable districts. The experience of Europe and eastern Asia has shown that if the mountains are stripped of their forests, populous districts will become flood-swept deserts of rock and sand.

To illustrate the views of the leaders of the great irrigation development that is taking place in the arid and semiarid regions of the West, I will quote the resolution passed by the Irrigation Congress held in Lincoln, Nebraska, September 27 to 30, 1897:

"Whereas, The perpetuation of the forests of the arid region is essential to the maintenance of the water supply for irrigation, as well as the supply of timber; therefore

"Resolved, That the President of the United States be memorialized, as soon as adequate provision be made for the protection of the forests and the regulation of the cutting of timber therefrom, to withdraw from entry or sale, under the act of Congress of March 3, 1891, all lands now in its [the Government's] possession which are of more value for their timber than for agriculture or for minerals."

REFORESTING AND PASTURAGE.—There is little doubt that the present forests in the arid and semiarid regions are but the remnants of large forested areas that were developed during a period of greater rainfall than exists at present. Such being the case, although it is pos-

sible under existing conditions to continue the present forests by judicious cutting and care of the young growth, it will be impossible to reforest the lands if the present method of lumbering and pasturing and the annual forest fires are continued. Where the rainfall is limited to a few weeks or months, the only water available for forest growth during the remaining portion of the year is that held in the soil by the presence of the forest cover. The experience of all who have attempted to start young trees in the open, semiarid country has been that, unless artificially watered during the dry season, the young trees die under the influence of the scorching sun and hot, dry winds.

As the result of a personal inspection of a considerable portion of the Sierra forest reserve of California, I am fully convinced that the preservation and development of the agricultural interests of the great wheat and fruit districts west of the range depend largely upon the preservation and increase of the forest covering of the region whose drainage is tributary to the agricultural areas. The same is true of the Los Angeles and San Bernardino areas of the southwestern portion of the State. Where the forest and brush have been removed, either by fire, cutting, or pasturage, the slopes are dry and dusty, the water flows off almost as rapidly as it falls, and carries along with it a load of sand and gravel to be deposited in the irrigation ditches and over the fields of the lowlands.

A comparison of such a denuded area with an adjoining forested or brush-covered district shows at once that the forest covering must be preserved if the water supply is to be stored by natural means for irrigation.

Of the influence of sheep pasturage on reforesting there is a difference of opinion among men acquainted with the forest reserves. In the semiarid region the struggle for existence is so great that all vegetation needs and must have the advantage of every condition at all favorable to its growth, if it is to grow at all. If the herbage and seedlings are destroyed by pasturage and the tramping of the sharp hoofs of sheep, the fate of the future forest growth and storage of water is settled, and its destruction foreordained. In the well-watered sections of Oregon, Washington, north Idaho, north Montana, and perhaps the Big Horn Mountains of Wyoming, the effect of pasturage of sheep would be very slight, as the growth of vegetation is rapid and luxuriant; but in the Sierra and southern reserves of California and similarly conditioned areas the damage is great, and even the pasturage of cattle in many localities will be detrimental. As soon as the reserves are carefully and intelligently studied by practical foresters, I think it will be found that each reserve has peculiar conditions that must be considered before com-

plete regulations for the administration of each can be determined upon.

STATE AND PRIVATE OWNERSHIP OF FOREST LANDS.—The proposition to dispose of the public lands of the Government by giving them to the States in which they are situated has often been under discussion, and in this connection it has been suggested that if the Government will give the forested lands to the States they will be better taken care of than by the General Government. This may be true, but as long as the forestry question is an interstate problem there will be great difficulty in adjusting conditions within a State so as to do full justice to the interests of the adjoining States. This applies more largely to fire protection and the water for irrigation than to timber supplies. If the General Government, however, should not establish a permanent and successful forest policy, I believe that it would be much better to give the forested lands to the States than to continue the system of waste and destruction that has existed in the past. There is no doubt that under State administration something would be done, but the chances are that it would come too late to be of avail in the permanent protection of the forests.

Private ownership of forest lands within or adjoining the forest reserves can not but be detrimental to the interests of the forests and to the people to whom they are tributary. Both individuals and corporations purchase the forested lands for the purpose of profit, and when this is secured, either by the cutting of the timber or by sale to other parties, their interest ceases. It is very rarely, except in the case of very large holdings, that any attempt at protection against destruction by fire is made, but any one who has traversed the forests of the West in the vicinity of settlements has seen the results of the cutting of the timber. If it happens that firewood is marketable, the land is swept clean of every tree upon it, and great piles of brush are left scattered over the ground, ready to carry the first fire that may reach them to the adjoining forest, and destroy every vestige of vegetation that may have escaped the axe in the area cut over.

CONCLUSIONS.—The question of the forest reserves has both a practical and a sentimental interest. Its practical bearings are felt by the people of the States in which the reserves are situated, and by those interests in adjoining States which are dependent upon the reserves for their timber supply and, in the arid and semiarid States, for water for irrigation, without which it would be impossible for the population of large areas to exist. The sentimental interest is largely among the people who, without any direct values at stake, feel that the element of the population that would waste the forest

must be restrained in its tendency to destroy what is the common heritage of the people at large in all areas to which the forests are tributary. There is also a large class who believe that it is worth while to protect the animal life of the forests, and to set aside areas where in the future the crowded population of the nation may have great public parks open to all for health and sport.

There is a strong tendency among thoughtful citizens of the States in which the reserves are situated, and in adjoining States, to favor the protection and wise administration of the forests on the public domain, and as soon as it is made manifest that this will be accomplished by the reservation policy the sentiment in favor of the reserves will be as great among the people directly affected as among those who now advocate the existence of the reserves from sentiment. In opposition to this is the relatively small but very active and influential class composed of those whose personal interests are directly affected by the reservation policy. Their opposition is based on expectation of immediate gain, regardless of the future of mining or agriculture, of property rights of the Government, or of the rights of the future generations which may occupy the region affected by the presence or absence of forests. From their point of view, opposition to any forest policy is reasonable, as it affects their capital and income, but it can not be sustained as against the welfare of the masses of the people of this and future generations. The policy of forest reserves has evidently come to remain, provided the attempt is not made to accomplish too much at once without regard to the rights of those having homes or property within the limits of the reserves. It is also essential that the reserves should not be kept as idle parks a day longer than is absolutely necessary to establish a system of administration that will provide for the use of the timber, protect the immature trees and undergrowth, and permit of the development of the mineral resources.

If the reserves are judiciously selected and honestly administered, and thus made to commend the policy to the American people, the difficulties to be met will be of little moment. That the reserves will be of great benefit to the communities to which they are tributary is absolutely certain, and it is also certain that in time the policy of forest reserves will develop into one of the most popular, beneficial, and valuable institutions of the Government. It is based on the experience and mature judgment of the most intelligent and progressive nations of the world, and if properly planned and administered its future in the United States will be all that its strongest supporters hope for.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(Lowell Institute Lectures, 1896.)

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XIII.—MODERN SOCIAL PROBLEMS.

HAS the intricate racial composition of the population of Europe, which we have been at so much pains to analyze, any significance for the student of social problems? Is there any reason why those who would rightly interpret sociological phenomena should first thoroughly acquaint themselves with the nature of the human stuff of which populations are compounded? Or have our conclusions, thus far, value merely as branches of investigation in pure science, a matter of academic interest alone? Such are the questions awaiting resolution at our hands in this paper of our series.

Let us begin by distinguishing between two equally competent and yet radically opposite explanations for any human phenomenon. One ascribes its origin to heredity, an internal factor; the other makes it a product of outward conditions—that is to say, of environment, social it may be, or physical. Thus the tall stature or blondness of an individual, a social class, or a people, may conceivably be due either to an inherited tendency from preceding generations, or else to the modifying influence of outer circumstances operative during a single lifetime.* Considering a single individual alone, a third factor—viz., chance variation—must needs be taken into account; but viewing men by wholesale, in large masses, this matter takes care of itself. Thus an odd drunkard, social reject, or criminal here and there in a community may be nothing more than an aberrant type; but if we discover a goodly proportion of such bad men, we are led to suspect a more fundamental cause. Chance does not work thus by wholesale, steadily in any given direction. Quetelet discovered this fact years ago. Confronted by any such phenomenon existing in appreciable proportions in any society, as revealed by statistical examination, we are therefore at once called upon to decide between our two original explanations. One runs it to earth, on the environmental theory; the other trees it in genealogical hypothesis. In plain English, it becomes a question of outward circumstances or else of inherited proclivities. On the first

* In the *Political Science Quarterly*, New York, x, 1895, pp. 642 *et seq.*, we have discussed this more fully.

supposition the phenomenon is of purely modern origin; in the second its roots are imbedded in the past. When the explanation thus becomes retrospective, if the people be in any wise homogeneous in characteristics, customs, or speech, we substitute another shorter word for inheritance. The whole matter simmers down to a decision between environment and race. Our problem in this paper is to adjudge a few such difficulties, whereby we may subserve a double purpose. We may discover what are the distinctive social peculiarities of the three races whose history we have been outlining; and we may form a definite idea of the class of remedies necessary to meet the peculiar needs of each community; for it is quite obvious that social evils due to inherited tendencies require very different treatment from those which are of recent origin, the product of local circumstances.

Purely environmental factors in social phenomena have been all too largely neglected by investigators in the past. At times they rise paramount to all other circumstances. One of the most striking instances of the influence of climate, for example, upon the distribution of population is offered by the present location of the cotton mills of Lancashire along the west coast of England. Why were these mills all set up about the city of Manchester, nearly a century ago? Why were they not placed where plenty of labor was at hand—viz., in the south and west, at that time the most densely populated district in England? The mills were not moved up into Lancashire, far from the crowd, because of the proximity to coal or iron. That may have in part induced them to remain there, when the choice had once been made. But before the days of the steam engine coal had no influence upon the selection of sites. Neither population nor coal being important elements, it is certain that climate was all-powerful in its attractiveness. Here, along the west coast, where the warm, moist Gulf-Stream winds blow steadily landward, is the most humid district in all England. In such an atmosphere the cotton fiber becomes naturally pliant and supple, rendering the spinning of thread a comparatively simple task. So considerable an element was this, that all sorts of devices were adopted for securing permanent benefit from the natural climatic endowment. Building sites were chosen on the western hill slopes, just where the humidity from the rising currents of air was greatest. Oldham and other towns above Manchester were located in accordance with it. Artificial ponds were created just west of the mills, so that the gentle winds blowing over them might become duly dampened. So subtle was this advantage that potted plants in the windows sometimes sufficed to humidify the air to just the right amount. Even to-day, with all the artificial devices for supplanting Nature's aid, we are

told by a manufacturer that a change of wind from east to west often makes a difference of seven or eight per cent in the product of a weaving shed.* To secure the precious humidity, factories have even at times been built half under ground, emulating the example of the Oriental makers of Dacca muslin, or "woven wind," who work sitting in holes in the ground, so that their delicate fabrics may be rendered supple by the moisture of the earth. Thus, perhaps, acting in this way, has the factor of climate been able to overcome the inertia of the large population once centering in southern England; for it has been compelled to transfer itself to the spot marked out by Nature for the industry.

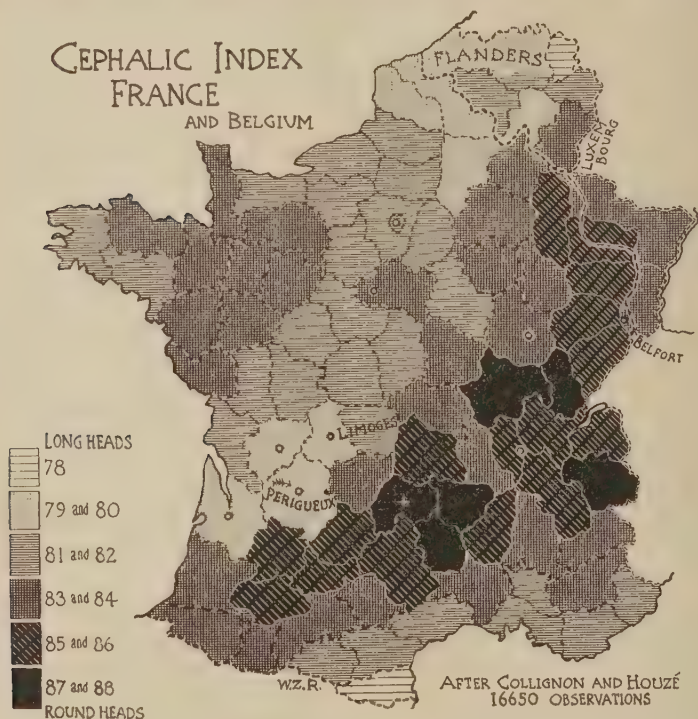
To decide between race and environment as the efficient cause of any social phenomenon is a matter of singular interest at this time. A school of sociological writers, dazzled by the recent brilliant discoveries in European ethnology, show a decided inclination to sink the racial explanation up to the handle in every possible phase of social life in Europe. It must be confessed that there is provocation for it. So persistent have the physical characteristics of the people shown themselves, that it is not surprising to find theories of a corresponding inheritance of mental attributes in great favor. Yet it seems to be high time to call a halt when this "vulgar theory of race," as Cliffe-Leslie termed it, is made sponsor for nearly every conceivable form of social, political, or economic virtues or ills, as the case may be.

This racial school of social philosophers derives much of its data from French sources. For this reason, and also because our anthropological knowledge of that country is more complete than for any other part of Europe, we shall confine our attention primarily to France. Let us refresh our memories of the subject. For this purpose we reproduce herewith a map from a former article, showing the distribution of the head form.† This we hold to be the best expression of the racial facts. On this map the dark tints show the localization of the Alpine broad-headed race common to central Europe in the unattractive upland areas of isolation. The light tints at the north, extending down in a broad belt diagonally as far as Limoges and along the coast of Brittany, denote the infusion of the blond, long-headed Teutonic race; while the similar light strip along the southern coast, penetrating up the Rhône Valley, measures the extension of the equally long-headed but brunette Mediterranean stock. The dotted area about Périgueux, in the southwest, we have

* For interesting data upon this point consult Transactions of the New England Cotton Manufacturers' Association, No. 57, pp. 185 *et seq.*; Edward Atkinson, in the Popular Science Monthly, 1890, pp. 306 *et seq.*

† Popular Science Monthly, vol. li, 1897, pp. 289 *seq.*

surely identified as a bit of the prehistoric Cro-Magnon race persisting here in relative purity. These ethnic facts correspond to physical ones; three areas of geographical isolation dark-colored are



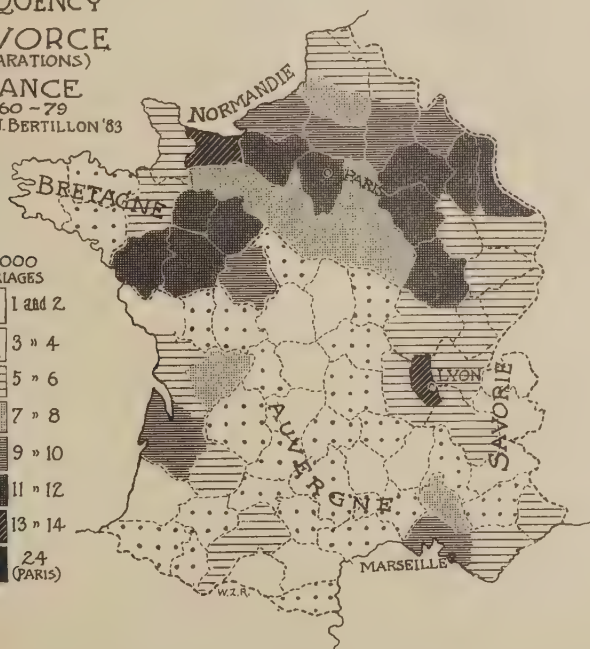
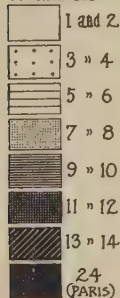
distinct centers of distribution of the Alpine race. These differ in intensity. The high Alps of Savoy are the most isolated of all; Auvergne, the south central plateau, follows next in order. These two are populated by quite pure Alpine types. Brittany, most accessible of the three, contains only an attenuation of this broad-headed race, the Teutons having infiltrated through it quite generally.

The organization of the family is the surest criterion of the stage of social evolution attained by a people. No other phase of human association is so many-sided, so fundamental, so pregnant for the future. For this reason we may properly begin our study by an examination of a phenomenon which directly concerns the stability of the domestic institution—viz., divorce. What are the facts as to its distribution in France? Owing to the influence of the Catholic Church, no actual divorces were allowed by law in that country prior

to 1884; but what were known as "*séparations de corps*," or judicial separations, were regularly granted. From data derived from the best authorities, we have prepared the map on this page, showing its relative frequency in different parts of the country. The dark tints correspond to the areas where it is most common. From this map it appears that marked variations between different districts occur. Paris is at one extreme; Corsica, as always, at the other. Of singular interest to us is the parallel which at once appears between this distribution of divorce and that of head form. The areas of isolation peopled by the Alpine race are characterized by almost complete absence of legal severance of domestic relations between husband and wife. The correspondence appears to be defective in Brittany, but this is largely because of arbitrary departmental boundaries. Savoy and Auvergne certainly show infrequency of such judicial separations on this map, a social characteristic which extends clear to the Pyrenees, in just the same way that the Alpine broad-headedness occupies the same country. A narrow Mediterranean strip seems to

FREQUENCY
DIVORCE
(SEPARATIONS)
FRANCE
1860-79
After J. BERTILLON '83

PER 1000
MARRIAGES



be marked off from it along the coast. The fertile valley of the Garonne is clearly outlined by increased frequency of separations, in marked contrast to the highlands on either side. This is, of

course, partly due to the concentration of population in cities along the river; for divorce is always more frequent in urban than in rural communities. The same consideration may also be important along the Mediterranean coast, for a large part of the population is here aggregated in cities, for peculiar reasons which will appear in due time. Even more strikingly the great basin of the Seine, center of Teutonic racial characteristics, stands sharply marked off from the whole south. This is most important of all.

Do the facts instanced above have any ethnic significance? Do they mean that the Alpine type, as a race, holds more tenaciously than does the Teuton to its family traditions, resenting thereby the interference of the state in its domestic institutions? A foremost statistical authority,* Jacques Bertillon, has devoted considerable space to proving that some relation between the two exists. Confronted by the preceding facts, his explanation is this: that the people of the southern departments, inconstant perhaps, and fickle, nevertheless are quickly pacified after a passionate outbreak of any kind. Husband and wife may quarrel, but the estrangement is dissipated before recourse to the law can take place. On the other hand, the Norman or the Champenois peasant, Teutonic by race, cold and reserved, nurses his grievances for a long time; they abide with him, smoldering but persistent. "Words and even blows terminate quarrels quickly in the south; in the north they are settled by the judge." From similar comparisons in other European countries, M. Bertillon draws the final conclusion that the Teutonic race betrays a singular preference for this remedy for domestic ills. It becomes for him an ethnic trait.

Another social phenomenon has been laid at the door of the Teutonic race of northern Europe; one which even more than divorce is directly the concomitant of modern intellectual and economic progress. We refer to suicide. Morselli devotes a chapter of his interesting treatise upon this subject† to proving that "the purer the German race—that is to say, the stronger the Germanism (e. g., Teutonism) of a country—the more it reveals in its psychical character an extraordinary propensity to self-destruction." On the other hand, the Slavic peoples seem to him to be relatively immune. These conclusions he draws from detailed comparison of the distribution of suicide in the various countries of western Europe, and it must be confessed that he has collected data for a very plausible case.

* *Études démographiques du divorce*, Paris, 1883, pp. 42 *seq.* Turquan, in *L'Économiste Français*, October 26, 1889, gives parallel results for the first five years of the new divorce law of 1884.

† *Suicide*, in the *International Scientific Series*, New York, 1882. A. M. Guerry, *Statistique Morale*, Paris, 1864, shows precisely the same thing.

There can be no doubt that in Germany the phenomenon culminates in frequency for all Europe, and that it tends to disappear in almost direct proportion to the attenuation of the Teutonic racial characteristics elsewhere.

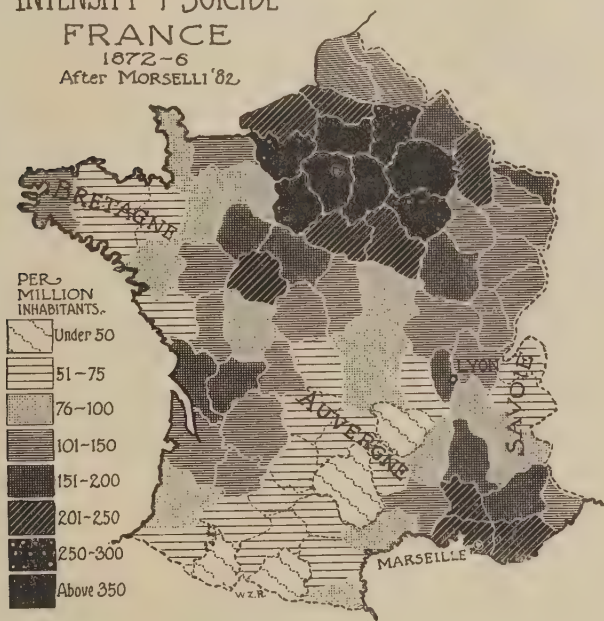
Consider for a moment our map on this page, showing the relative frequency of suicide, with the one on page 472, which we have already described as illustrating the ethnic composition of France. The parallel between the two is almost exact in every detail. There

INTENSITY OF SUICIDE

FRANCE

1872-6

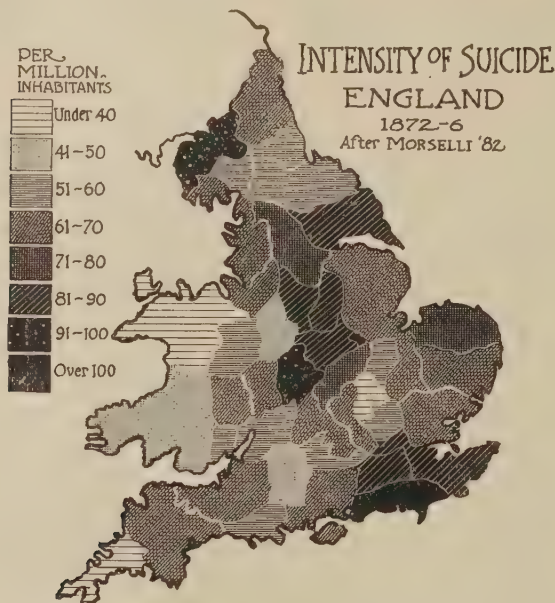
After MORSELLI '82.



are again our three areas of Alpine racial occupation—Savoy, Auvergne, and Brittany—in which suicide falls annually below seventy-five per million inhabitants. There, again, is the Rhône Valley, and the broad, diagonal strip from Paris to Bordeaux, characterized alike by strong infusion of Teutonic traits and relative frequency of the same social phenomenon. The great Seine basin is sharply differentiated from the highlands along the eastern frontier; and even the Mediterranean coast strip, distinct from the Alpine and Auvergnat highlands, is indicated. Inspection of these maps betrays at once either a relation of cause and effect or else an extraordinary coincidence.

Consideration of the distribution of suicide in England lends

still greater force to Morselli's generalization. Herewith is a map of its variations. Observe how Wales and Cornwall are set apart from all the rest of the island. Were the map more extensive, we should discover the Scottish Highlands, the third stronghold of the ancient Briton types, characterized by an equal infrequency of suicide. Most remarkable of all is the little light-colored area, just north of London, comprising the counties of Hertfordshire, Bedford, and Huntingdon. This district we were at great pains to emphasize in



our article upon the British Isles as a region where the physical characteristics of the pre-Teutonic invaders of the island were still represented in comparative purity. We saw that the conquering Teutons entered England from two sides, avoiding London and the impenetrable fen district, and thereby passed over this region, leaving it notably brunette in physical type to this day. Here, again, in nearly every detail of our map would seem to be a corroboration of Morselli's law. For suicide diminishes in direct proportion to the absence of Teutonic intermixture.

Divorce and suicide, which we have just discussed, will serve as examples of the mode of proof adopted for tracing a number of other social phenomena to an ethnic origin. Thus Lapouge attributes the notorious depopulation of large areas in France to the sterility incident upon intermixture between the several racial

types of which the population is constituted. This he seeks to prove from the occurrence of a decreasing birth rate in all the open, fertile districts where the Teutonic element has intermingled with the native population.* The argument has been advanced a stage further even than this; for purely economic phenomena, such as the distribution of property, tax-paying faculty, and the like, are in the same way ascribed to purely racial peculiarities.† Because wealth happens to be concentrated in the fertile areas of Teutonic occupation, it is again assumed that this coincidence demonstrates either a peculiar acquisitive aptitude in this race, or else a superior measure of frugality.

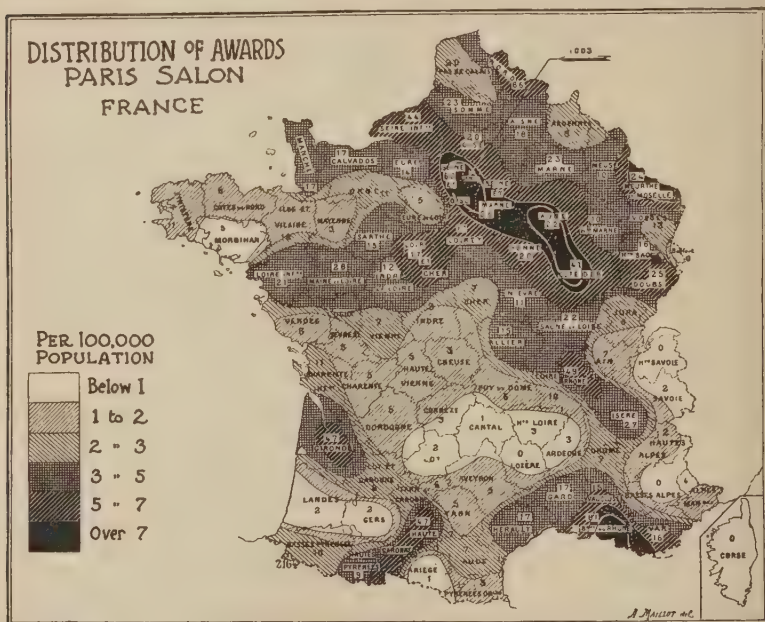
By this time our suspicions are aroused. The argument is too simple. Its conclusions are too far-reaching. We can do better for this race than even its best friends along such lines of proof. With the data at our disposition there is no end to the racial attributes which we might saddle upon our ethnic types. Thus, judging from mere comparison of our map of head form with others of social statistics, it would appear that the Alpine type in its sterile areas of isolation was the land-hungry one described by Zola in his powerful novels. For, roughly speaking, individual landholdings are larger in them on the average than among the Teutonic populations. Peasant proprietorship is more common also; there are fewer tenant farmers. Crime in the two areas assumes a different aspect. We find that among populations of Alpine type in the isolated uplands offenses against the person predominate in the criminal calendar. In the Seine basin, along the Rhône Valley, wherever the Teuton is in evidence, on the other hand, there is less respect for property; so that offenses against the person, such as assault, murder, and rape, give place to embezzlements, burglary, and arson.‡ It might just as well be argued that the Teuton shows a predilection for offenses against property; the native Celt an equal propensity for crimes against the person. Or, again, why does not the Alpine type appear through statistical eyes as endowed with a peculiar aptitude for migration? For the sterile upland areas of his habitation are almost invariably characterized by emigration to the lowlands and to the cities.

* *Revue d'Économie Politique*, ix, 1895, pp. 1002-1029; x, 1896, pp. 132-146. This we have already discussed in *Publications of the American Statistical Association*, v, 1896, pp. 18 *et seq.*

† *Corrélations financières de l'indice céphalique*, *Revue d'Économie Politique*, 1897, p. 257. See also *The hierarchy of European races*, in *American Journal of Sociology*, Chicago, iii, 1897, pp. 314-328.

‡ For maps showing the distribution of all these, consult A. M. Guerry, *Statistique Morale*, etc., Paris, 1864. Fletcher, in the *Journal of the Royal Statistical Society*, London, xii, 1849, pp. 151 *seq.*, gives many interesting maps for England. See also Yvernes, in *Journal de la Société de statistique*, Paris, xxxvi, 1895, pp. 314-325.

The persistence of a higher birth rate in these districts makes such relief to an ever-increasing population necessary. Finally, why not apply the same mode of proof to the artistic or literary attributes of population? Turquan* has recently mapped the awards made by the *Salon*, at Paris, according to the place of birth of the artist. We reproduce this directly herewith, not because it proves anything racially, but because it might as well be adduced as proof of the artistic bent of Teutonism in France as many another map above mentioned. For, broadly viewed, the artistic instinct, measured by the canons



of the *Salon's* judges, seems to cling persistently, as Turquan concludes, to the fertile river basins, which are the great centers of Teutonic populations. Nevertheless, we are convinced, despite the geographical coincidence, that it is not the factor of race, but rather of social environment, education, the inspiration of contiguous culture, which is really the responsible agent in the case. That it is not race but rather circumstances which makes for these higher things in civilization, we may, I think, prove, if we but include a number of different countries within the purview of our comparisons. We are fortunate in possessing an artistic census of Italy, not incom-

* La Statistique aux Salons, Revue Politique et Littéraire, Paris, série 4, vi, 1896, pp. 207 seq.

parable with that of France.* Bellio has distributed the poets, painters, and sculptors of antiquity according to their place of birth, over a map of that country. The effect has been to emphasize the enormous preponderance of artistic genius all through the north, from Tuscany to the Alps. How does this coincide with our previous deduction concerning France? It seems, perhaps, to corroborate the relation of Teutonism to art, until we recall the fact that all northern Italy is overwhelmingly Alpine by race, as compared with the artistically sterile south. Couple with this the fact that in reality Teutonism is a negligible factor in Italy, physically speaking, and that precisely the same ethnic type in France, which is so fecund culturally in Italy, is the one localized wherever art is not; and all doubt as to the predominant cause of the phenomenon is dissipated. We see immediately that the artistic fruitfulness in either case is the concomitant and derivative product of a highly developed center of population. Contact of mind with mind is the real cause of the phenomenon.

This mode of destructive criticism, appeal to the social geography of other countries wherein the ethnic balance of power is differently distributed, may be directed against almost any of the phenomena we have instanced in France as seemingly of racial derivation. In the case either of suicide or divorce, if we turn from France to Italy or Germany, we instantly perceive all sorts of contradictions. The ethnic type which is so immune from propensity to self-destruction or domestic disruption in France, becomes in Italy most prone to either mode of escape from temporary earthly ills. For each phenomenon culminates in frequency in the northern half of the latter country, stronghold of the Alpine race. Nor is there an appreciable infusion of Teutonism, physically speaking, herein, to account for the change of heart. Of course, it might be urged that this merely shows that the Mediterranean race of southern Italy is as much less inclined to the phenomenon than the Alpine race in these respects, as it in turn lags behind the Teuton. For it must be confessed that even in Italy neither divorce nor suicide is so frequent anywhere as in Teutonic northern France. Well, then, turn to Germany. Compare its two halves in these respects again. The northern half of the empire is most purely Teutonic by race; the southern is not distinguishable ethnically, as we have sought to prove, from central France. Bavaria, Baden, Württemberg are no more Teutonic by race than Auvergne. Do we find differences in suicide, for example, following racial boundaries here? Far from it; for Saxony is its culminating center; and Saxony, as we know, is really half Slavic by heart,

* *Rapporti fra l'etnografia antica dell'Italia e la sua produttiva artistica*, Boll. Soc. geog. Italiana, Roma, xxiii, 1886, pp. 261-279, maps.

as is also eastern Prussia. Suicide should be most frequent in Schleswig-Holstein and Hanover, if racial causes were appreciably operative. The argument, in fact, falls to pieces of its own weight.

A summary view of the class of social phenomena seemingly characteristic of the distinct races in France, if we extend our field of vision to cover all Europe, suggests an explanation for the curious coincidences and parallelisms above noted, which is the exact opposite of the racial one. In every population we may distinguish two modes of increase or evolution, which vary according to economic opportunity for advancement. One community grows from its own loins; children born in it remain there, grow up to maturity, and transmit their mental and physical peculiarities unaltered to the next generation. Such a group of population develops from within, mentally as well as physically, by inheritance. Such is the type of the average rural community. It is conservative in all respects, holding to the past with an unalterable tenacity. Compare with that a community which grows almost entirely by immigration. Stress of competition is severe. There is no time for rearing children; nor is it deemed desirable, for every child is a handicap upon further social advancement. Marriage, even, unless it be deferred until late in life, is an expensive luxury. Population grows, nevertheless; but how? By the steady influx of outsiders. Such is the type known to us in the modern great city. Between these two extremes are all gradations between the progressive and the conservative type of population. To the former are peculiar all those social ills which, as Giddings has rightly urged, are the price paid for such progress. Suicide is a correlative of education; frequency of divorce is an inevitable concomitant of equality of rights between the sexes, and the decline of the religious sanction of *patria potestas*. A decreasing birth rate almost always attends social advancement. To prevent such a fall in the birth rate, and at the same time to overcome the devastations of disease, is held by many to be the demographic ideal to which all states should aspire. Not postponed marriages, not childless families, not a high proportion of celibates; not, on the other hand, reckless and improvident unions, with a terrific infant mortality as a penalty therefor; but a self-restrained and steady birth rate in which a high percentage survive the perils of infancy. "Civilization is the baptism of the passions. In the cloister neither does the mother die of fever nor the child of croup; but outside the cloister to find both mothers and children, and bring both well through fever and croup—that is civilization." * Could we for

* From a very suggestive paper, A Measure of Civilization, in Journal of the Royal Statistical Society, London, lx, 1897, pp. 148-161.

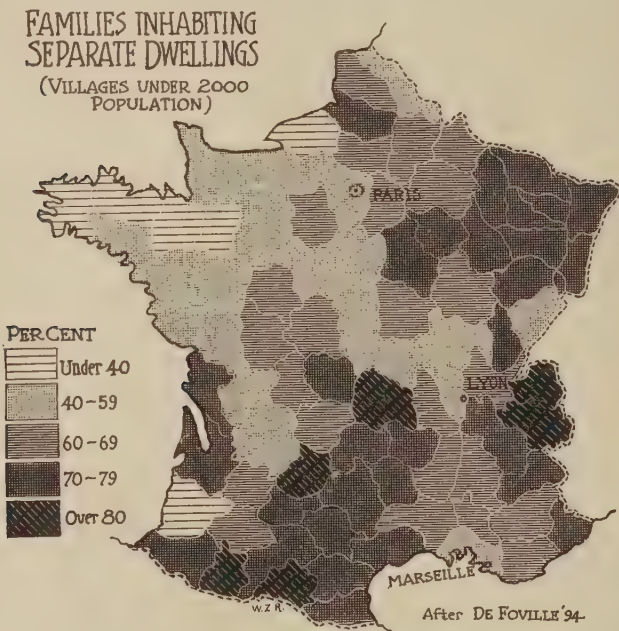
France apply this last-named criterion of progress? I doubt not we should find it to accord with all the facts we have instanced above. To ascribe them to racial causes is to lose sight of the primary factors in social evolution.

Our theory, then, is this: that most of the social phenomena we have noted as peculiar to the areas occupied by the Alpine type are the necessary outcome, not of racial proclivities, but rather of the geographical and social isolation characteristic of the habitat of this race. The ethnic type is still pure for the very same reason that social phenomena are primitive. We discover, primarily, an influence of environment where others perceive phenomena of ethnic inheritance. In the preceding paragraph we have referred to the apparently disintegrating influence of social evolution upon domestic institutions. Let us for a moment turn to another phase of family life in France, in order to illustrate the complex forces which play upon it to-day. The danger of rashly generalizing from inadequate data will be immediately apparent.

An index of the solidarity of the family is afforded by the degree to which it resents the interference of the state in its domestic affairs. A similar expression of the force of family feeling is often rendered through the tenacity with which it holds itself aloof from the intrusion of strangers not allied by blood or adoption to the other members of the naturally close corporation. In other words, statistics of what we may call "home families," or families occupying an entire dwelling by themselves, give us a clew to the cohesiveness of the institution. It is the question of the boarding house and the tenement *versus* the home. Any direct comparison in this respect between different parts of the same country is of course entirely worthless, unless we take account of the relative proportions of city population in each; for, always and everywhere, it is in the crowded city that the "home" is superseded by its degenerate prototypes. Fortunately, we possess for France data upon this subject, with the necessary elimination of this cause of error. The accompanying map shows the proportion of families occupying each a whole house to itself, and with the exclusion of all cities of upward of ten thousand inhabitants in every case. In other words, we have before our eyes statistics of the separately existing families among the French peasantry.

Inspection of this map of "home families" shows the widest range of variation. Some parts of France, notably Brittany, exhibit twice the degree of domestic intermixture, so to speak, that prevails in other regions. On the whole, the northwest manifests a weaker opposition to the intrusion of strangers in the family circle than does the south. In some respects this agrees with the testi-

mony of divorce, as to the cohesiveness of the domestic institution. So far as Savoy, Alsace-Lorraine, and Auvergne, our principal areas occupied by the Alpine or Celtic race, are concerned, the parallel with the map of divorce is quite close. The Mediterranean coast strip, nay, even the intrusive zone up the Rhône Valley, are indicated as areas where the family is less cohesive than in the upland areas of isolation. But what shall we say about Brittany? Racially, and in stability of the family as well, it belongs with Savoy



and Auvergne as an area of isolation, characterized by comparatively backward social phenomena. Nevertheless, inspection of our map shows it to be the region where such "home intermixture" is exceedingly prevalent. Less than one half the families live under entirely separate roofs, whereas in the other Celtic areas the proportion of independent families is often above ninety per cent.

This peculiar anomaly in the case of Brittany is all the more notable, as this region is one of the most conservative in all France, judged by the character of its social phenomena. Some disturbing factor is evidently at work. It seems to be purely environmental. Surprising as it may appear, this exaggerated "home intermixture" in the Armorican peninsula is apparently to a large degree referable to its geological and climatic peculiarities. Levasseur makes some

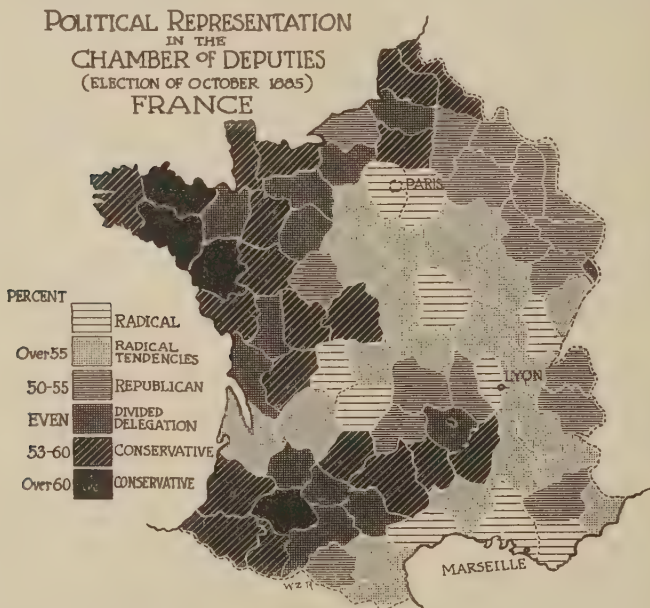
interesting observations upon this subject.* Where peasant houses are closely aggregated or bunched in little villages, it is easy for each family to maintain its separate dwelling, and yet for them all to co-operate with one another in daily labor. On the other hand, the peasant whose house is quite apart from those of his neighbors, placed squarely, perhaps, in the center of his landed property, must of necessity take his farm laborers into his own household. Thus, where population is scattered evenly over a district, not in closely built hamlets, but in widely separated houses, it generally happens that there is considerable "home intermixture." Several families or parts of families live under the same roof. Applying these considerations to Brittany, it seems as if the very low percentage of separate "home families" were a result of just such a broadcast distribution of population. This absence of hamlets in turn is a direct result of geology and climate. In Brittany the rainfall is very heavy; water courses and springs abound on all sides. The soil is at the same time thin, overlying an impervious granite formation. This makes it possible to build houses wherever convenient, without anxiety concerning water supply. The exact opposite of this occurs along the dry Mediterranean coast, where water is a marketable commodity; and in those departments with a permeable chalk soil, where water disappears rapidly in subterranean streams. In these latter cases houses inevitably collect about the water courses and springs, and a high proportion of aggregated population at once is manifested, with all that is thereby implied, socially speaking. One of the first results would be that each family in such a hamlet might occupy its own dwelling exclusively.

Geographical factors have also operated in still another way in Brittany to discourage the growth of closely built villages. This region is so remote from any of the routes of military invasion from the east that no necessity has ever arisen for compacting the population in villages capable of ready defense. Levasseur gives this as an important element in producing the contrasts in the proportion of urban population between the different parts of France. In all of our areas of isolation, the Alps, Auvergne, or Brittany, protected by Nature against intrusion of enemies, the population can safely scatter as it will. In any case, as we have said, the effect upon the family, especially in all that concerns its separate existence under a roof by itself, is very patent.

If the geographical isolation peculiar to the areas occupied by the Alpine race is thus potent in the way we have indicated, why may it not appear in political as well as in social affairs? Conserva-

* Bulletin de l'Institut Internationale de Statistique, iii, 1888, pp. 70 *et seq.*

tism should be its motto. To test this we have studied minutely the results of a general election of deputies from all over France, held in 1885. We chose this example for the reason that this important political event was the last supreme effort, the expiring gasp of the monarchical party in France. It is the last time that the conservative element obtained any formidable representation in the Chambers at Paris. From ninety-five deputies standing for a return to the old *régime* in the preceding Chambers, the number advanced to one hundred and eighty-three; it nearly doubled, in other words. Three million three hundred thousand conservative votes, in a total suf-



frage of 7,500,000, was a very respectable, even formidable, showing. This remarkable overturn was due to a fortuitous conjuncture of events. The Ferry republican ministry had been recklessly extravagant; its policy in Tonquin was unpopular. Disturbing local issues were, however, rare, so that the main questions at home were calculated to appeal directly to any intellectual or moral prejudices which happened to be abroad. The Radical party stood for the separation of Church and State; universal suffrage in senatorial and presidential elections was a leading issue. It was an exceptional occasion in every respect for reviving the smoldering fires of conservatism, while at the same time affording opportunity for the fullest expression of progressive ideas, wherever they were present. The election,

therefore, was squarely a question of the old *versus* the new. By analysis of its results, we may perhaps gain an inkling of the temper of the people.

Our map herewith denotes by its lightest shades the areas of most advanced modern ideas where the radicalism of the nineteenth-century type had cut itself loose from all bonds with the past. The opposite extreme, where both politics and religion combined to rejuvenate the conservative party, is tinted black. The intermediate gradation of sentiment is demonstrated by the degrees of light or dark shading. Inspection of this map reveals a certain parallelism with all those that we have studied heretofore. Especially do we note the conservatism of Brittany, Auvergne, and the southwest. It should be said that the apparent conservatism of the most northern departments was due to the local protection-and-free-trade issue, complicated by the Boulanger episode. For this reason these manufacturing centers should be eliminated from our comparison. Savoy and the high Alpine departments also were strongly affected by their proximity to the republican institutions in Switzerland. We must allow for that fact also. A curious contrast, ever persistent in all our ethnic or social maps, is that which is manifested between the coast strip along the Mediterranean and the mountains north of it. A light strip of radicalism extends all along the sea and up the Rhône Valley, setting apart Auvergne from Savoy. Whether this radicalism bears any relation to the high percentage of urban population hereabouts—a product partly of climate, as we have seen—or whether it is an expression of the impulsive temperament of the Mediterranean race, we leave it to others to decide. It is a fact, at all events.

Having made allowance for all the disturbing factors above named, it is roughly true that the areas of Alpine racial occupation manifest a distinct tendency toward conservatism in politics. We incline to the belief that here, again, is the influence of physical circumstances appreciable. Cliffe-Leslie, keenly alive to the weakness of the old dollars-and-cents political economy, may have been right, after all. He concludes: "One may, I think, point with certainty to the difference of environment and conditions of life in the mountains and in the plains, as the source of the superior force of religion, family feeling, and ancient usage in the former. On its moral and social side the contrast between mountain and plain is the contrast between the old world and the new; between the customs, thoughts, and feelings of ancient and modern times." Politics at one extreme, ethnology at the other, have afforded us constant proof of the truth of this generalization. The close interrelation which of necessity exists between every form of human phenomenon in a

naturally developed society is a second corollary from the same law. Of profound significance for the sociologist, however, is the fact that to-day we are rapidly passing from such natural organization to a new and highly artificial one. Problems of city life confront us on every side. They are not devoid of ethnic importance; investigation is concentrating upon them. In the final paper of our series we shall proceed to their consideration.



SCIENTIFIC PROGRESS IN THE CLOSING CENTURY.*

BY PROF. LUDWIG BÜCHNER.

CENTURY of enlightenment—century of science—century of reconciliation—as such respectively may be characterized the eighteenth, the nineteenth, and the twentieth centuries; though in so characterizing the last we have somewhat forestalled time. But the designation of the present century as that of science can hardly be disputed; for progress in human knowledge and in consequent power has been so great and far-reaching in this century, and so rapid within the last few years, that in this respect no preceding century can at all compare with this.

ASTRONOMY.—It is known that Copernicus, fearing clerical persecution, was compelled to hold back his great work on the revolutions of the heavenly bodies for thirty years, and that when finally published it was condemned and prohibited as heretical. The telescope also was put under the ban, because, according to the view of the Church, it permitted men to see farther than God by the structure of the human eye intended them to see. Nevertheless, it was the telescope that put a definite end to the narrow notions arising from the geocentric error, and ousted the earth and its inhabitants from their imagined high place as center of the universe. But the crowning of the astronomical edifice founded on these discoveries occurred only in the century at whose exit we are standing, and this through the founding of the important science of astrophysics and the knowledge acquired thereby of the chemical and physical constitution of the heavenly bodies by which we are surrounded. These researches were initiated by the wonderful discovery made in 1859 by Kirchhoff and Bunsen of the spectral analysis or the language of light, which has furnished special elucidation of the chemico-physical constitution of the sun, which elucidation must have appeared impossible to previous science. Spectrum

* From Prof. Ludwig Büchner's book, *Am Todtenbett des Jahrhunderts*, which is about to be published in Germany.

analysis, also, in conjunction with the study of the curious double stars (which have been more exactly recognized within the last decade and are now known by the thousand) has brought about the highly important conviction of the unity of what is to us the visible universe, and the correspondence of its elements and forces and of the laws by which the whole is governed. In the same science, the progressive improvement of the astronomical perspectives and giant telescopes has furthermore made possible a much more extended insight into the infinite depths of the universe, and, supported by the art of photography, has made known the existence of new stars—among them fixed stars or suns—a hundred or a thousand times as great as our sun. Even more important is the discovery in the same manner of those strangely rotating primeval nebulæ, composed of incandescent gases, which are nothing else than stellar systems in a state of formation. Observation of these has raised to almost a certainty the theory of Kant and Laplace as to the origin of those systems. One of the strangest of those systems is the great nebula in Andromeda which can be seen with the naked eye. The photographic image of this object, obtained by the English astronomer Dr. Roberts, by means of a twenty-inch reflecting telescope, exhibits distinctly the various phases of its development. The improved telescopes of the present time have furthermore provided us with such an intimate knowledge of the constitution of the surface of our moon that it is now better known than some parts of the surface of the earth—as in the interior of the great continents of Africa, Australia, and America. Similar information, though to be taken with reserve, was obtained from the remarkable phenomena observed on the surface of the planet Mars. The interpretation of these features has not been thus far absolutely settled, but in the opinion of eminent astronomers they indicate the presence on that planet of thinking beings. To the present century also belongs the somewhat older discovery of the planet Neptune, which was made in such a wonderful way by Leverrier and Galle in 1846. This discovery must be regarded as one of the greatest triumphs of astronomical science, since it was the fruit of a demonstration by mathematical calculations of the existence of a heavenly body, while the actual finding and identification of it were achieved afterward by means of the telescope. In like manner, by the application of the laws of gravitation to the peculiar movements of the magnificent fixed star Sirius (the Dog Star of the ancients), its character as a double star was recognized twenty years before Clark, in Boston, discovered, on January 31, 1862, its companion, and by this discovery furnished the weightiest argument in support of the universality of the law of mass attraction.

PHYSICS.—With astronomical science ranks, as a matter of course, physical science and the great discovery of the conservation or persistence of force, which now like an animating breath pervades all natural sciences, and deserves to be classed with the greatest discoveries of all time. Guessed and clearly predicted by Friedrich Mohr as early as 1837, this principle received its scientific confirmation from the German Robert Mayer (1842) and the Englishman Joule (1842-'49). Both these scientists had worked independently of each other. The validity of this great theory was first established by proving the identity of heat and motion (because proof as to these was easiest), and, the mechanical equivalent of heat having been calculated, was very soon fixed for all the forces of Nature. Thus the unity and immortality of force were demonstrated.

The physics of our century shows another great advance in what is called the kinetic theory of gases, for which Clausius and Maxwell paved the way, and which permits us a deep insight into the infinite fineness of matter and the inconceivable velocity of its internal motion. According to Clerk Maxwell, the most minute living being that can be seen under the most powerful microscope still contains a million (according to Tait, two million) organic molecules or atomic groups; so that we can not form any conception whatever of the incalculably great number of the finest histological elements for which perhaps no method of investigation is at our command. Finally, the century, shortly before its departure, has accomplished in the physical domain one of its most valuable feats by the discovery of the X or Röntgen rays, which permit our eye to penetrate to the innermost depths of objects hitherto regarded as opaque, and thereby make almost true the marvels of the Arabian Nights. Not less wonderful and unexpected is the success, likewise belonging to very recent time, attained by the experiments in liquefying and solidifying gases, like oxygen, nitrogen, carbonic acid, chlorine gas, and atmospheric air.

CHEMISTRY.—As regards the domain of chemistry, this science, not to mention the numerous smaller discoveries important to industry and therapeutics, has achieved one of its greatest triumphs by its surprising penetration into the organic domain, and the consequent elucidation of the relation of the vegetable and animal metabolism. These discoveries, chiefly initiated by the renowned Liebig, in the years 1848-'55, were productive of the most beneficial results in the development of the physiological and medical sciences, as well as in agriculture. As a consequence of this knowledge, we have to greet the successful experiments in the artificial production of organic matter or the chemical synthesis inaugurated by the French chemist Berthelot in 1856. At present a whole series of genuine

organic substances, such as alcohol, various kinds of ether, grape sugar, organic acids, fats, alkaloids, vegetable oils or perfumes, etc., are being manufactured in a purely chemical way, and the hope is well founded that in course of time we may also succeed in preparing directly from the elements sugars and albumins—yea, even the protoplasm or that organic primal substance out of which all living beings are evolving. What chemistry even now is capable of achieving is shown by the preparations made from coal tar of practicable pigments, perfumes, saccharines, and drugs.

Finally, we must mention in this place the discovery of *argon*, a hitherto unknown element of the atmospheric air, as well as the successful preparation of *acetylene* by Professor Moisson. This is a luminous gas which is sixteen times stronger than common gas, and has five times the illuminating power of Auer's gaslight.

GEOLOGY.—As we owe to the progress in chemistry the refutation of the theory of a vital principle, geology in like manner has disproved, chiefly through the labors of the gifted English geologist Lyell (1830-'33), the formerly accepted theory of great physical catastrophes or terrestrial revolutions and of separate acts of creation, and has shown that the past of the history of our globe (which in its evolutionary process advances slowly but continuously) is nothing but its unrolled present.

PALEONTOLOGY.—In close connection with geology is paleontology, or the knowledge of the former life of our globe. This has been raised to the rank of a science only during the present century. Now this science has so far advanced that we can survey the gradual development of the entire organic world, and find that those transitional and intermediate forms required of the evolutionary theory are no longer missing. The vast North American plains are especially remarkable as having been found to be rich treasure houses of such forms.

ANATOMY.—Closely connected with paleontology are anatomy and the discovery made in this science of the cell as the primordial element or fundamental form of the whole organic world. This discovery was made by Schwann and Schleiden in 1839, after the microscope had been brought, through the efforts of Amici, to such a perfection as to make possible by its use the more and more subtle investigation of animal tissue. Through the discovery of the cell, the unity, as to kind and origin, of everything living was demonstrated; and it was shown that even the highest and most complicated organisms were simply combinations of cells in a more or less changed condition. Then, in 1859, Virchow made an ingenious application of the cell theory to medical science. Virchow, in his *Cellular-Pathologie*, searched in the modified cell for the nature

of disease, and promulgated that doctrine, so bold for his time, "*Omnis cellula ab cellula*" (every cell from a cell)—a doctrine that will always stand like a corner stone of the temple of science. The continuity of everything living expressed by this doctrine was confirmed later on by the progress made in comparative anatomy, so that the fundamental plan common to the type of vertebrates could be traced to its last details, and it was shown that between animal and human structure the characteristic of distinction is not absolute, but only relative. Of special importance in this connection is the proof that even the organ of mind—i. e., the brain—is no exception to the general rule, and that it is built on a common fundamental plan in both man and animal.

After all, not much had been gained for a philosophical view of Nature and a natural explanation of generation, in its inception, by the discovery of the cell as the primordial form of the organic world, the cell itself being too high and complicated a formation to be regarded as rudimentary. There was therefore a hiatus in our knowledge which gave the opponents of the theory that the world is the result of a series of changes governed by natural laws a convenient ground for declaring the theory untenable and false. But this difficulty also was removed by the discovery (likewise belonging to our century) of protoplasm, or the original primordial substance, made by Max Schulze in 1863. This protoplasm, consisting of shapeless organic matter, is identical with Haeckel's celebrated *monera*, or those formless albumin lumps, those organless organisms out of which the true cell only develops after a long series of intermediate stages. And the *moner* itself, in all probability, is not the first step, but the ultimate product of previous stages of development in the process of the transformation of the inorganic into the organic. Naegeli's mechanico-physiological theory of descent goes even so far as to declare the distance between the *moner* and the true primordial plasma substance far greater than that between the *moner* and the mammal! In the light of these discoveries and the consequent conclusions, the much-ventilated question of primal generation, which formerly was covered by impenetrable darkness, no longer presents any difficulty in the way of scientific explanation.

PHYSIOLOGY.—In close connection with anatomy and the history of evolution, which are occupied with the physical building up of the organisms, stands physiology, or the science of the functions of the organs. Here we notice, in the first place, the great discovery made by von Baer, in 1827, of the *ovum* of the mammals and of man, in its original place in the *ovary*. This discovery was soon after followed, in 1844, by the elucidation by Th. Bischoff of the

process of fecundation and generation, which theretofore had been wrapped in the deepest obscurity. Four years later, in 1848, followed Du Bois-Reymond's researches in animal electricity and the proof that the nerve is not, as formerly believed, a mere conductor, but a self-generator of the electricity originated by chemical metabolism and the transformation of what is designated as potential force or elasticity into living force or motion by virtue of the great principle of the conservation of force.

Under the head of physiology, special mention must also be made of the great successes that accompanied the researches of Messrs. Schiff, Ferrier, Munk, Nothnagel, Hitzig, Fritsch, Broca, Flechsig, and others concerning the localization of the various activities of the soul, or the divisions of labor taking place in the brain, and the topographical distribution of certain functions of the brain on its surface—researches which have not by any means reached their end. The most important among these is the discovery, made first by Broca, in 1861, of the controlling center of speech at a definite place in the fore part of the brain. Morbid degeneration or destruction of this spot is the cause of *aphasia*, or speechlessness. This discovery also satisfactorily explains why the large man-like apes which are almost devoid of that part of the brain can not speak, notwithstanding the formation of their larynges is similar to that of man. Not less important are the entirely new researches of Professor Flechsig on the so-called centers of association in the brain and the definite proof furnished by him that all thinking springs from the senses, inasmuch as it is only by the gradual development of those centers that the action of the different organs is connected, and thus thinking and intelligence are made possible.

ZOOLOGY.—Besides the numerous acquisitions of systematic zoology, special mention should be made here of the researches as to the life in the sea. These have been prosecuted largely through the zoological marine stations supported by Government, and have been rendered more effective by means of improved apparatus which made possible the acquisition of knowledge as to the deep-sea fauna. The results enabled Haeckel to establish his renowned *Gastræa* theory, according to which all animal species—however far differentiated—owe their primal origin to a single primitive form of the greatest simplicity that might be properly designated as “primitive stomach.” To the zoological researches of the century we are also indebted for the better knowledge of those strange animal creatures nearest to man whose existence was still doubted or relegated to the realm of fable as late as the last century even by scholars, although as early as 500 B. C. the Carthaginian Hanno had seen gorillas on the western coast of Africa, and described them as wild “haired men.”

Now, the so-called anthropoids or large manlike apes may be seen either dead or alive in many museums and zoölogical gardens.

BIOLOGY.—Closely connected with zoölogy is biology, or the science of life, which undoubtedly has achieved the greatest progress made by physical science in the century by the promulgation and victory of the theory of descent by evolution, a theory brought forward by Darwin in 1860, and developed by Haeckel and others. Nearly related to it are the above-mentioned remarkable discoveries in the domain of paleontology and the knowledge of numerous intermediate forms which formerly had been disregarded as unimportant "varieties."

ARCHÆOLOGY.—The existence of the fossil man, which had been doubted so long, has been proved, and the geological age of the human race established. The series of discoveries coming under this head was opened in the years 1830-'40 by the discovery, made by the French scientist Boucher de Perthes, of man-made diluvial flint axes in the Somme Valley in the north of France. Since then the researches concerning the age and the preliminary history of mankind have become the favorite study of the time and of scholars, and there has come into being within a comparatively short time a literature on this subject the wealth of which can hardly be surveyed. The discoveries in this vast and interesting domain are accumulating from year to year to such an extent as to give rise to a new and successful science of archæology. While on the one hand this science teaches us that the existence of man on earth must be shifted back into hoary ages to which the historical period can not be compared at all, it shows us, on the other hand, that this period considered geologically—i. e., when compared with the periods of evolution of the earth—is of itself a very recent and new one. It is for this reason that the origin of man must be regarded as the crowning or culminating point of the whole organic evolution—a point beyond which the development of the world was no longer carried on by Nature, but by man. A highly desirable completion of these studies on the primal history of the human race was supplied by the great progress in ethnology made possible by the enormous traveling facilities of our century.

PSYCHOLOGY.—Closely related to anthropology is psychology, as to which the conviction prevails in authoritative circles that it should not be classed with the philosophical sciences, but with the physical; or at least that it must be treated after the physical method if any tangible result is to be attained. It was this mode of treatment that achieved the afore-mentioned result of the measurement of the duration of human thought. We owe also to this method the better knowledge of the animal soul and the foundation for com-

parative psychology, analogous to comparative anatomy, which latter has been in an advanced stage for a long time. Finally, in the psychological domain we owe to modern times the knowledge of the strange phenomena of double consciousness and of hypnotism with the phenomena of suggestion, the study of which is calculated to throw on the mental being more light than could the most voluminous works on psychology of former times, which were the result of self-observation and self-deification. Unfortunately, these phenomena have given food to the inextirpable belief in miracles, and furnished new support for unfounded spiritualistic and spiritistic chimeras of every kind, such as thought-reading, telepathy, magnetic *rapport*, the belief in ghosts, spooks, etc.

MEDICINE.—If we finally mention medicine or therapeutics as a branch of physical science we have here also to record a series of the most important advances in the course of the century. At the head stands the method of auscultation or of listening by means of an ear trumpet to the sounds in the chest in order to discover disease in the lungs and the heart. This method was invented by the French physician Laennec in 1819, soon after the method of percussion had been improved by Piorry, while the foundation of pathological anatomy through Professor Rokitansky, and of pathological histology by Professor Virchow, which soon after followed, advanced medicine to a real science. Another invention, highly important in practice—subcutaneous injection—was made by A. Wood in 1850. More recent than all this is the very important discovery of the infectious micro-organisms or bacteria as the causes of disease. This discovery, which led to the application of disinfection, in common with the introduction of chloroform and cocaine as anæsthetics, on the one hand, cleared the way for the acknowledged wonderful progress made in surgery, and, on the other hand, materially facilitated the combating of diseases caused by those organisms by prophylactic measures.

We must also allude to the invention of a great number of new remedies obtained by means of chemistry, as well as of new methods of curing ailments (e. g., massage). We must mention, too, the general introduction of vaccination, which has proved one of the greatest blessings to mankind. Whether the injection of fluids as an immunity against certain diseases (e. g., diphtheria), tried according to the same method, will fulfill the hope entertained is a question the solution of which must be awaited after the unfortunate failure of a similar procedure employed in tuberculosis. It seems, however, as though this so-called “serum therapeutics” in its further development might accomplish great results in the field of infectious diseases. The ascertaining and location of internal diseases (particu-

larly as to the skeleton) has likewise been advanced, as previously referred to, in marvelous manner by the application of the "X" or Röntgen rays to the illumination of the human body.

To the great progress in human knowledge must be added the no less gigantic advances in power accomplished by the nineteenth century, and effected by the greater knowledge and mastery of the forces of Nature. Above all must be noticed here the forces acquired by the control of steam, conquering all resistance and giving birth to those noble children of the century—railroads and steamboats. This has brought the powers of legendary giants under the commanding hand of man. A few decades have been sufficient to span the greater part of our globe with space and time annihilating messengers, and by means of the even more marvelous inventions of the telegraph and telephone to bring into direct communication with each other the most distant parts of the earth's surface. Another child of this our century is the phonograph, whose astonishing achievements remind us of fairy tales; and another is the art of photography, which, as already said, has with an unanticipated success been placed in the service of science (astronomy, telescoping, geography, and ethnography). Its instantaneous pictures have brought it about that the successive movements of a complete occurrence are separately reproduced before our wondering eyes as though we saw a repetition of the actual scene. This art, however, still awaits one of its greatest triumphs in the production of colored pictures. We must also mention the invention of dynamite, a product making practicable the exertion of unprecedented energy, and so indispensable wherever great mass effects are to be attained; and also of smokeless powder, which may prove beneficent in abating or even completely abolishing the great continental wars.

Finally, our century has witnessed the union of electric force with chemistry and technics in the form of electro-chemistry and electro-technics, which open the brightest vistas into the future. For the wonderful force of electricity excels in readiness of application and utility all other forces of Nature, and beyond any other vanquishes the checking barriers of space and time. It can, without any special means, be almost directly derived from or changed into all other forms of natural force, and proceeds with an extraordinary velocity through the prescribed paths of the conducting wires. It can, therefore, at any moment be conducted to any place where its effect is required. Dwellings are now illuminated by electricity almost everywhere, and if heating by the same agent and the cooking of food by means of it become common, then is foreshadowed an almost paradisiacal state, in place of the conditions of existence now

prevailing with their attendant trouble, uncleanness, dust, vexation, and disease. And should electro-technics succeed—as there is well-founded hope that it will—in solving the problem of obtaining electricity direct from the fuel, instead of by an expensive indirect method as heretofore, the far-reaching effect of such success can scarcely be overestimated. As with respect to material progress this century is fittingly called the Century of Steam, so most likely the coming century will have to be designated the Century of Electricity, when the more extended control of the forces of Nature by the human mind shall have taken an immense stride in the forward direction. If we add to all this that the grand material as well as intellectual development of the great land of liberty in the far West of our globe, the like of which has never been seen before, promises to continue in the same or even a higher degree, then the men of the coming century will of necessity be more profoundly impressed than the children of the present by the achievements of human intellect and human power.

It may be that we are, with respect to the coming century, in the same immature mental condition in which the people of the eighteenth century were with regard to the nineteenth. If some one in the preceding century had dared to predict the wonderful achievements of the nineteenth, he would probably have been declared a fool, and treated as was Robert Mayer, in Germany, in this century, who, after the discovery of the law of the conservation of force, was put into an insane asylum. A like fate might befall the man who should dare now to cast a horoscope for the twentieth century, and to predict the progress of the human mind in the various domains of scientific research. After all, those may be right who, in spite of all those acquisitions on which we so justly pride ourselves, are of opinion that we are still moving in only the initial steps, in the leading strings of evolution, and that we are yet very far from the goal of those material and ideal aims which the human race in its unremitting onward struggle is destined to attain, or to show its capacity of attaining. The great Sir Isaac Newton used, perhaps, the most appropriate simile when he compared men with children who on the seashore are picking up here and there a curious pebble or colored shell while the great sea of truth lies still unexplored before them. We can only conjecture as to the probable progress, as we can not know which position we occupy in the course of human evolution, whether we are still in its beginnings or well advanced. This lies hidden in the bosom of the future. We therefore discontinue this line of thought, and remark here again that unfortunately this great progress in knowledge and power in our century has not extended to the moral, general intellectual, literary,

or social domains, and perhaps we should except also the realm of politics. To grasp and to establish the hitherto wanting but yet so necessary harmony between being and thinking will probably be the chief task of the century soon to come in.

As regards the sciences thus far not mentioned (philosophy, theology, jurisprudence), there is, to our knowledge, much movement to be noticed, but comparatively little real progress. An exception must be made as to history, which as *Kulturgeschichte* (history of civilization) has assumed a scientific character contrasting markedly with its previous form. The same is true of the history of religion, which has given a well-deserved attention to the ancient Hindu religions, especially the venerable religion of Buddha; furthermore, the successful study of antiquity, which, especially in connection with a branch of physical science or geology as archaeology, has furnished the most valuable disclosures as to pre-historic times. Political economy, statistics, and hygiene also may look back on their achievements with pride. The ethics of moral science has also derived great profit from the revelations of physical sciences on the gradual acquisition and transmission through heredity of mental and moral qualities. The like can be said with even more emphasis of general philology, which happily applied the principles of the theory of evolution to the great problem of the origin of languages, and proved that the laws according to which species and languages originate, grow, and, through the extinction of intermediate links, separate from each other, are identical.

Furthermore, in all domains of human knowledge, without exception, a great number of important and valuable detail researches have been made which, in their totality, also tend to raise their respective sciences to a higher level.

M. FERDINAND BRUNETIÈRE, the distinguished French critic, who recently came to the United States to deliver a course of lectures, confesses to having met some difficulties in a search he made to find a typical American. At Baltimore, as at New York, all that he observed of original or local seemed to bear an element of cosmopolitanism. The "American" or English professor of whom he borrowed a pencil was a German. A lady whose manner, physiognomy, and language struck him as American, was of French origin. Another person of "American" manners spent half the year in Paris or Switzerland. The man who asked him how he liked Baltimore was a Russian. He found, too, Italians, Greeks, Jews, and what not, of "American" aspect and manners, and wondered when he would meet an American born in America of American parents, or who had not been subject to influences from abroad. "No," he says, "race has not in America any more than in Europe the importance that is given it."

EVOLUTIONARY ETHICS.*

BY HERBERT SPENCER.

THE following letter, published in the *Athenæum* for August 5, 1893, was drawn from me in response to certain passages in the Romanes Lecture, delivered by the late Prof. Huxley at Oxford in the Spring of 1893.† These passages were supposed to be directed against doctrines I hold (see *Athenæum*, July 22, 1893); and it seemed needful that I should defend myself against an attack coming from one whose authority was so great. My justification for including this letter among these fragments is that since the Romanes Lecture referred to exists in a permanent form, it is proper that a permanent form should be given to my reply.

If it is not too great a breach of your rules, will you allow me space for some remarks suggested by the review of Prof. Huxley's lecture on "Evolution and Ethics," contained in your issue of the 22nd inst.?

The incongruity between note 19 of the series appended to the lecture, and a leading doctrine contained in the lecture itself, is rightly pointed out by your reviewer. In the lecture Prof. Huxley says:—

"The practice of that which is ethically best—what we call goodness or virtue—involves a course of conduct which, in all respects, is opposed to that which leads to success in the cosmic struggle for existence. In place of ruthless self-assertion it demands self-restraint."—P. 33.

But in note 19 he admits that—

"strictly speaking [why not rightly speaking?], social life and the ethical process, in virtue of which it advances towards perfection, are part and parcel of the general process of evolution, just as the gregarious habit of innumerable plants and animals, which has been of immense advantage to them, is so."

* From Various Fragments, by Herbert Spencer, in press of D. Appleton and Company.

† As the Romanes Lecture was published in the *Monthly* (November and December, 1893), it seemed fitting that this reply to some of the more important points raised by Professor Huxley should also be given to our readers. We accordingly put the letter in type soon after it appeared in *The Athenæum*, but at the request of Mr. Spencer it was withdrawn. He having now given it permanent form, we feel at liberty to carry out our original intention.—THE EDITOR.

I do not see how the original assertion can survive after this admission has been made. Practically the last cancels the first. If the ethical process is a part of the process of evolution or cosmic process, then how can the two be put in opposition? Prof. Huxley says:—

“The struggle for existence, which has done such admirable work in cosmic nature, must, it appears [according to the view he opposes], be equally beneficent in the ethical sphere. Yet, if that which I have insisted upon is true; if the cosmic process has no sort of relation to moral ends; if the imitation of it by man is inconsistent with the first principles of ethics; what becomes of this surprising theory?”—P. 34.

But when we find that the hypothetical statement, “if the cosmic process has no sort of relation to moral ends,” is followed by the positive statement that “the cosmic process” *has* “a sort of relation to moral ends,” we may ask, “what becomes of this surprising” criticism? Obviously, indeed, Prof. Huxley cannot avoid admitting that the ethical process, and, by implication, the ethical man, are products of the cosmic process. For if the ethical man is not a product of the cosmic process, what is he a product of?

The view of which Prof. Huxley admits the truth in note 19 is the view which I have perpetually enunciated: the difference being that instead of relegating it to an obscure note, I have made it a conspicuous component of the text. As far back as 1850, when I did not yet recognize evolution as a process co-extensive with the cosmos, but only as a process exhibited in man and in society, I contended that social progress is a result of “the ethical process,” saying that—

“the ultimate man will be one whose private requirements coincide with public ones. He will be that manner of man who, in spontaneously fulfilling his own nature incidentally performs the functions of a social unit; and yet is only enabled so to fulfil his own nature, by all others doing the like.”—*Social Statics*, “General Considerations.”

And from that time onwards I have, in various ways, insisted upon this truth. In a chapter of the *Principles of Ethics* entitled “Altruism *versus* Egoism,” it is contended that from the dawn of life altruism of a kind (parental altruism) has been as essential as egoism; and that in the associated state the function of altruism becomes wider, and the importance of it greater, in proportion as the civilization becomes higher. Moreover, I have said that—

"from the laws of life it must be concluded that unceasing social discipline will so mould human nature, that eventually sympathetic pleasures will be spontaneously pursued to the fullest extent advantageous to each and all."—*Ethics*, § 95.

"With the highest type of human life, there will come also a state in which egoism and altruism are so conciliated that the one merges in the other."—*Ib.*, appended chapter to Part I.

Everywhere it is asserted that the process of adaptation (which, in its direct and indirect forms, is a part of the cosmic process) must continuously tend (under peaceful conditions) to produce a type of society and a type of individual in which "the instincts of savagery in civilized men" will be not only "curbed," but repressed. And I believe that in few, if any, writings will be found as unceasing a denunciation of that brute form of the struggle for existence which has been going on between societies, and which, though in early times a cause of progress, is now becoming a cause of retrogression. No one has so often insisted that "the ethical process" is hindered by the cowardly conquests of bullet and shell over arrow and assegai, which demoralize the one side while slaughtering the other.

And here, while referring to the rebarbarizing effects of the struggle for existence carried on by brute force, let me say that I am glad to have Prof. Huxley's endorsement of the proposition that the survival of the fittest is not always the survival of the best. Twenty years ago, in an essay entitled "Mr. Martineau on Evolution," I pointed out that "the fittest" throughout a wide range of cases—perhaps the widest range—are not the "best"; and said that I had chosen the expression "survival of the fittest" rather than survival of the best because the latter phrase did not cover the facts.

Chiefly, however, I wish to point out the radical misconceptions which are current concerning that form of evolutionary ethics with which I am identified. In the preface to *The Data of Ethics*, when first published separately, I remarked that by treating the whole subject in parts, which would by many be read as though they were wholes, I had "given abundant opportunity for misrepresentation." The opportunity has not been lost. The division treating of "Justice" has been habitually spoken of as though nothing more was intended to be said; and this notwithstanding warnings which the division itself contains, as in § 257, and again in § 270; where it is said that "other injunctions which ethics has to utter do not here concern us . . . there are the demands and restraints included under Negative Beneficence and Positive Beneficence, to be hereafter

treated of." Even if considered apart, however, the doctrine set forth in this division has no such interpretation as that perversely put upon it. It is represented as nothing but an assertion of the claims of the individual to what benefits he can gain in the struggle for existence; whereas it is in far larger measure a specification of the equitable limits to his activities, and of the restraints which must be imposed on him. I am not aware that any one has more emphatically asserted that society in its corporate capacity must exercise a rigorous control over its individual members, to the extent needful for preventing trespasses one upon another. No one has more frequently or strongly denounced governments for the laxity with which they fulfil this duty. So far from being, as some have alleged, an advocacy of the claims of the strong against the weak, it is much more an insistence that the weak shall be guarded against the strong, so that they may suffer no greater evils than their relative weakness itself involves. And no one has more vehemently condemned that "miserable *laissez-faire* which calmly looks on while men ruin themselves in trying to enforce by law their equitable claims" (*Ethics*, § 271).

Now that the remaining parts, treating of Beneficence, have been added to the rest, the perverse misinterpretation continues in face of direct disproofs. At the very outset of the *Ethics* it is said:—

"There remains a further advance not yet even hinted. For beyond so behaving that each achieves his ends without preventing others from achieving their ends, the members of a society may give mutual help in the achievement of ends."—§ 6.

And in a subsequent chapter it is said that

"the limit of evolution of conduct is consequently not reached until, beyond avoidance of direct and indirect injuries to others, there are spontaneous efforts to further the welfare of others." "It may be shown that the form of nature which thus to justice adds beneficence, is one which adaptation to the social state produces."—§ 54.

These are texts which in Parts V. and VI., dealing with Beneficence, Negative and Positive, are fully expanded. Having first distinguished between "kinds of altruism," and contended that the kind we call justice has to be enforced by the incorporated society, the State, while the kind we call beneficence must be left to individuals, and after pointing out the grave evils which result if this distinction is not maintained, I have described in detail the limits to men's actions which negative beneficence enjoins. Then come two chapters, entitled "Restraints on Free Competition" and "Restraints on

Free Contract," respectively indicating various cases in which the restraints imposed by law must be supplemented by self-restraints, and instancing one of the excesses committed under free competition as amounting to "commercial murder." Chapters enjoining further self-restraints for the benefit of others are followed, in the division on Positive Beneficence, by chapters enjoining efforts on their behalf, and the duty which falls on the superior of mitigating the evils which the inferior have to bear. After dealing, in a chapter on "Relief of the Poor," with the evils often caused by attempts to diminish distress, it is contended that philanthropic duty should be performed not by proxy, but directly; and that each person of means ought to see to the welfare of the particular cluster of inferiors with whom his circumstances put him in relation. The general nature of the doctrine set forth may be inferred from two sentences in the closing chapter:—

"The highest beneficence is that which is not only prepared, if need be, to sacrifice egoistic pleasures, but is also prepared, if need be, to sacrifice altruistic pleasures."—§ 474.

And then, speaking of the natures which "the ethical process" is in course of producing, it is said that

"in such natures a large part of the mental life must result from participation in the mental lives of others."—§ 475.

I do not see how there could be expressed ideas more diametrically opposed to that brutal individualism which some persons ascribe to me.

It remains only to say that Prof. Huxley's attack upon the doctrines of Ravachol & Co. has my hearty approval, though I do not quite see the need for it. Evidently it is intended for the extreme anarchists; or, at least, I know of no others against whom his arguments tell. It has been absurdly supposed that his lecture was, in part, an indirect criticism upon theories held by me. But this cannot be. It is scarcely supposable that he deliberately undertook to teach me my own doctrines, enunciated some of them forty-odd years ago. Passing over the historical and metaphysical parts of his lecture, his theses are those for which I have always contended. We agree that the process of evolution must reach a limit, after which a reverse change must begin (*First Principles*, chaps. "Equilibration" and "Dissolution"). We agree that the survival of the fittest is often not survival of the best. We agree in denouncing the brutal form of the struggle for existence. We agree that the ethical

process is a part of the process of evolution. We agree that the struggle for life needs to be qualified when the gregarious state is entered, and that among gregarious creatures lower than man a rudiment of the ethical check is visible. We agree that among men the ethical check, becoming more and more peremptory, has to be enforced by the society in its corporate capacity, the State. We agree that beyond that qualification of the struggle for life which consists in restricting the activities of each so that he may not trench upon the spheres for the like activities of others, which we call justice, there needs that further qualification which we call beneficence; and we differ only respecting the agency by which the beneficence should be exercised. We agree in emphasizing, as a duty, the effort to mitigate the evils which the struggle for existence in the social state entails; and how complete is this agreement may be seen on observing that the sentiment contained in Prof. Huxley's closing lines is identical with the sentiment contained in the last paragraph of the *Principles of Ethics*. Obviously, then, it is impossible that Prof. Huxley can have meant to place the ethical views he holds in opposition to the ethical views I hold; and it is the more obviously impossible because, for a fortnight before his lecture, Prof. Huxley had in his hands the volumes containing the above quotations, along with multitudinous passages of kindred meanings. But as this erroneous belief is prevalent, it seems needful for me to dissipate it. Hence this letter.

The closing lines of this last paragraph were regarded by Prof. Huxley as tacitly charging him with an unacknowledged adoption of my views. It did not occur to me when writing them that they could be so interpreted. My intention was simply to show that he had abundant opportunity for seeing at first hand what my views were, and had therefore the less reason for presenting his own similar views as though they stood in opposition to mine.

As an example of the work that may be done for scientific geography in Africa, Mr. J. Scott Keltie cited, in the British Association, the discovery made by Mr. Moore, a young biologist trained in geographical observation, on Lake Tanganyika, of a fauna held to be of a salt-water type, which seems to afford a key to the past history of the center of the continent. Mr. Moore believes that the connection of this part of Africa with the coast was not by the west, as Joseph Thomson surmised, but by the north, through the Great Rift Valley of Dr. Gregory.

PRINCIPLES OF TAXATION.

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XV.—WHAT IS PROPERTY?

ONE of the greatest obstacles in the way of framing a correct system of general taxation, is the different and wholly antagonistic opinions that popularly prevail, as to the real nature of what constitutes its chief objective in respect to administrative action, namely, "property." This point finds full confirmation and illustration by reference to the several definitions that have been given to this term by various recognized authorities, and have been accepted to a greater or less extent as authoritative by a general and even educated public. Thus, as before noted, a widely accepted definition of Professors Macleod, Perry, and others is, that everything that can be bought or sold is property. Thus, even the random ideas of an anarchist are a form of wealth at present, just as the "goaks" of Artemus Ward used to be—because they have exchangeable value, and will bring a certain number of dollars to him, or to the reporter or interviewer who gives his notions to the public. So the beauty of an actress, the nimble legs of a dancer, the vocal sweetness of an opera singer, are also forms of wealth, since they have an exchangeable value when utilized. And hence the folly of the socialists, who suppose that by dividing property, or equalizing the distribution of land, they can secure equality of wealth, since diversities of human faculty and opportunities would instantly begin to make this imperfect distribution more unequal than before. Thus the Greek philosopher Aristotle, speaking of the division of land among all the citizens of his time, has the credit of shrewdly saying, "Either all kinds of property must be equalized, or all must be let alone." According to Webster's Dictionary, that "to which one has a legal title" is property. And in a report of a recent lecture, a leading American theologian is credited with saying to an assemblage of divinity students that "he adopted as the basis of his discussion of property the 'profound and perfect' definition of the Roman Catholic theologian Brownson, namely, that 'property is communion with God through the material.' And to realize and apply this definition is the great duty of the Christian teacher."

"The term property denotes a right over a determinative *thing*. Property is the right of any person to possess, use, enjoy, and dispose of a thing."—*Eaton vs. Boston*, 51 N. H., 504.

A more rational conception of the exact nature of property, or rather of what property consists, would, however, seem to lead to

this conclusion, namely, that property, at least for the purpose of taxation, is always a *physical actuality, with inhering rights or titles, the product solely of labor, and is always measured in respect to value and for exchange by labor.*

Thus, for example, a fish *free in the ocean* is not property; but when it has been caught through the instrumentality of labor it becomes property. Property, furthermore, can not be created except by an application of labor of some kind to material substances, which because they are substances and in order to be substances must have both a *corpus*, or an entity, and a *situs*, or a situation. Human labor incorporated in things, and thus saved to those who acquire the things, is also what constitutes value or capital; and nothing can be capital but the existing results of previous labor, which can contribute to man's enjoyment and well-being.

It is interesting also to note in this connection how the etymology of the Latin words *possessus* and *possideo*, namely, *po* and *sideo*, to *sit by* or *on*, and from which in turn we have the English word *possession*—the common definition of property being something possessed—curiously harmonize with and confirm the conclusion that property must be always a physical actuality. For it is clear that it is only a material something, a visible and tangible entity, that one can sit down on, and not an invisible, intangible nothing, the fiction of law or of the imagination.

A limitation, little recognized by legal writers and authorities, on the exercise of the right of *eminent domain* (the name given to the power inherent in state sovereignty of making a compulsory purchase of private property for public use), also sustains the correctness of the definition of property as above given; inasmuch as this right is never conceded or made applicable to other than an *actuality*, and never to a mere representative of something that is not material. Thus one of the illustrations of Roman jurisprudence handed down by Tacitus was to the effect that an emperor was not allowed to appropriate the right to carry a stream of water through the lands of a private individual, but did pay damages for the injuries thereby accruing to the lands.

All investigation on this subject can therefore, it is believed, lead to but one conclusion, and that is that *property is always "embodied or accumulated labor."* And as political economy does not, and jurisprudence ought not to take cognizance of *châteaux en Espagne*, these are the only senses in which political economy and the law can legitimately reason about property.*

* The statement is frequently made that all value is the product of labor. Adam Smith says, "Labor is the fund which originally supplies a nation with its wealth." McCulloch says, "Labor is the only source of wealth"; and all the early writers, in one form or

Examples of property which is apparently not the result of accumulated or of any labor, and so militating against these conclusions, will doubtless suggest themselves: such, for instance, as a diamond found upon the seashore, land squatted upon and obtained by pre-emption, bank stock, patent rights, copyrights, annuities obtained by gift or purchase, franchises, monopolies, and debts; but an examination will soon prove that the objections embodied in them are more specious than real. Thus, in the case of the diamond accidentally picked up, which is perhaps one of the most striking of all the examples that can be adduced in favor of the position that property can come into existence without the agency of labor, it may be said: first, that an exceptional fact like this can not constitute an adequate basis for the enunciation of a principle; and, next, that the value of this accidental diamond is solely determined by and represents the value of the labor which has been required to obtain all other existing diamonds. The moment the fact ceases to be exceptional, the moment diamonds can be had in abundance by merely picking them up, that moment their value will simply represent the cost of the physical effort requisite to pick them up. Again, if land squatted upon has any value as property whatever in the first instance, it is because it is the embodiment of the labor required to discover it, to conquer it, to defend and protect it; to effect all of which, taxes, which are the results of labor, may have been paid for centuries. If it acquires any additional value beyond this, after it has been

another, say the same thing. Accepting under such circumstances an entire misconception of the true meaning of the word *labor*, the popular mind has been drawn to the conclusion that hand labor or muscular exertion is the producer of all value; and has added the corollary that hand labor is therefore entitled to the entire value thus produced. But when closely examined, the true meaning of the word labor will be found to be, *all that a man can do, either with his muscle or his brain*. On this crude misconception of the meaning of words, philanthropic systems have grown up, under which the weaker ones have lost heart, and the stronger ones have grown desperate, because the hard sense of humanity does not accept their theories. Also, through their influence, these ideas have reacted and are reacting on the laborers themselves, with rather lamentable results. Thus it is a very general complaint of the present time that the ordinary workman, the person commonly understood by the word "laborer," puts so little mind into his or her work that it is perfunctory to the last degree; concerns itself very little with results, but expends its efforts in a function whose sole end is to escape blame or actual discharge, and to get along with the least possible exertion; when the fact is, that the three functions of capital (which is accumulated labor), labor (in the muscular sense), and management (or brain power) must as a rule act conjointly, in order to insure the best results. "In more recent times, a truer appreciation of this word has arisen, but even yet has not been so absorbed into the general fund of knowledge as to bear practical fruits; and it needs to be constantly dwelt upon, set forth, reiterated, and explained, until it shall become a common possession of those who think." The reason why more attention has not been given to this subject by the earlier economists has been assigned to the fact that they drew their illustrations from a very primitive life, where the bow and spear figured prominently.—*Address, American Social Science Association, 1892, by F. J. Kingsbury, LL. D.*

squatted upon, it will be simply because the results of labor have become connected with it, or the value of other land or other property the products of labor, for the use of which labor competes, are reflected upon it. In 1620 the land upon which the city of Boston stands could have been bought for a string of sea shells; in 1894 its value for assessment as property for taxation was probably in excess of \$900,000,000. But in both instances the valuation was determined by one and the same standard: in the first, by the amount of labor required to collect and string the shells; and in the second, by the amount of labor and capital—which is the result of labor—which has been embodied in the land or become connected with it. Take away the labor and its accumulated results, and the site of Boston will be worth no more at the present time than it was in 1628, when William Blackstone first obtained it.

Analyze next the alleged property in bank notes. The coin in the vaults of the bank, the vaults, the building, the books, the furniture, and other physical actualities—the results of labor—employed in transacting the business of banking, are the real property of the bank. The bank stock, so long as the bank exists, is merely a right to receive dividends. The creation of a bank obviously does not create any property. The notes discounted by the bank over its counter are inchoate titles to the debtor's property or to his rights to property; and the notes issued by the bank are inchoate titles to the bank's property or to its equitable rights to property. The bank, apart from its physical actualities and machinery, is simply a ledger recording credits and debits. But credits and debits are only convenient forms of bookkeeping, or the records of transfers of property and of rights, titles, and interests in property pre-existing. Credits and debits, moreover, stand to each other in the relation of an equation. There can be no credit without a debit, and no debit without a credit; strike out one side of the equation, and the other disappears of necessity. If there were no creditors there could be no debtors, and, *vice versa*, the moment debtors cease to be debtors, that same moment creditors cease to be creditors.*

Copyrights and *patents* are simply legislative enactments to protect pre-existing property. A manuscript, a painting, or an invention is the joint product of physical and intellectual labor, which the copyright or patent right protects, the same as other forms of law protect other visible and tangible property from robbery and spoliation. The relation which these instrumentalities sustain to property is clearly indicated by asking the question, whether there can be such a thing as a patent granted for what has never been reduced to

* The Supreme Court of Alabama has recently decided that when a bank in that State owns real estate the same is not liable to taxation as a part of its capital stock.

a physical actuality; or a copyright given for the flight of fancy of a poet not embodied in the materiality of a manuscript or in the pages of a printed book. John Milton sold *Paradise Lost* to Samuel Simmons, bookseller, for *five* pounds ready money; but Gray's "mute, inglorious Miltons," who only imagined and never wrote, could never have obtained a copyright or any money offer whatever—no, not even reputation—for their imaginings, though for all that the world knows they might have been infinitely superior to the Milton who became glorious because he was not mute, in all that relates to mental attainment.

"A person can read from a book, can quote from it, use its ideas in speaking and writing, and even attempt to pass them off as his own, and he will find no legal obstacle to such action. But the moment he tries to duplicate the material form in which the ideas appeared, that moment he passes from the realm of the intangible to that of the tangible"; for the book, which is the concrete thing in which the author has embodied his ideas, is an *entity*, and because an entity representing embodied labor is property which the law will protect to the owner, and can also legitimately tax, if it will. There have been repeated decisions by the courts * that there can be no property in ideas—until, for example, an author through a copyright, or an inventor through a patent, has put his ideas in such tangible form that the Government can put its stamp upon them.

It is also exceedingly curious to note how Shakespeare, whose range and accuracy of knowledge were so wonderful, clearly perceived, and as clearly expressed, the whole essence of modern political economy and jurisprudence in respect to this immediate problem, when, in the following lines from *A Midsummer-Night's Dream*, he says:

"The poet's eye, in a fine frenzy rolling,
Doth glance from heaven to earth, from earth to heaven,
And, as imagination bodies forth
The forms of things unknown, the poet's pen
Turns them to shapes, and gives to airy nothing
A local habitation and a name."

* Some years since an action was brought in a United States court by one Kortenhaus against the American Watch Company, of Waltham, Mass., to recover royalties on an improvement in stem-winding watches that he made, and which, he averred, the defendants had put to use without his consent and without awarding him any compensation therefor. The plaintiff swore that he had submitted his invention to the company's inspection with the view of selling it, but it refused to purchase, and he discovered afterward that the company had adopted the improvement, and that he had made the mistake of not patenting it. The court dismissed the action, and ruled that there was no right of property in an idea as an idea, and that it could only be made property by letters patent. Had, however, a patent been secured upon the improvement, its value as property would have been undoubtedly very considerable.

In other words, according to Shakespeare, as well as according to political economy and common sense, however brilliant may be the imagination of the poet or inventor, he has no property in his ideas or imaginings until he has reduced them through labor to an actuality. And then the value of the actuality produced for the purpose of exchange or sale, provided there is a copyright or a patent to prevent use without compensation, will be just in proportion to the effectiveness or desirability of the labor exerted upon or embodied in it. The standard for measuring the value of the work of a Shakespeare, a James Watt, and a street sweeper is one and the same.

Again, an annuity, like a bank stock, is a right to receive property, the result of previously accumulated labor, and its transfer by sale or bequest is simply a transfer of an equitable right; and a right of this character, in turn, is not property, but a title to pre-existing property. So, also, in respect to *franchises*, which, although often spoken of and regarded as property, are clearly nothing but rights. Thus, for example, a franchise of a railroad is simply a right to operate a road in a particular manner; and a legislature can not and does not create a railroad by creating or granting a franchise. At the same time, the value of a physical actuality may undoubtedly be increased by a franchise which gives a right to use such actuality in a particular way. A monopoly, also, like a franchise, is valuable, but its value consists in the fact that it gives to certain persons privileges that are taken from others, and the making of a monopoly no more creates property than does the making of a franchise.

Some persons, whose opinions are worthy of respect, have raised a point in discussing this question, that there is a distinction to be recognized between property and capital; and that both in law and political economy the latter does not necessarily conform to the definition that has been here given to the former. But can there be such a thing as capital which does not represent a physical actuality in the sense of embodied labor? Capital is the interest of a person in embodied labor over and above his debts, or his interest in legal or equitable rights to embodied labor, and can have no value, and is merely imaginary, except it has the right, title, or power to command embodied labor, or to exercise dominion over property the result of labor. All that we labor and toil for is embodied labor. We will not give our labor for the "baseless fabric of a vision," or our accumulated labor for the dreamy creations of a Berkeley or the imaginary castles of poets, except so far as they make them manifest in material forms or writings.

By some, also, the forces of Nature are regarded as property; but

they are not so until dominated over and subjugated by man; and then only do they acquire value and become negotiable and subject to proprietorship. Gravity and electricity, as free forces, are incapable of sale and taxation; nor can they, in any rational view, be considered as property. According to recent decisions of the courts of the United States, electricity is not a manufactured product, and electric-light plants do not manufacture it, but only distribute it.

WHAT ARE TITLES TO PROPERTY?—But while political economy recognizes nothing as property except physical actualities, the law, for the sake of convenience, has so long treated titles as conveying the same ideas as property, that the profession and the public have very generally come to regard the two as equivalent or identical. Consideration is, therefore, next asked to this point.

Property being embodied and accumulated labor, it becomes endowed, in all places where the rights of labor are recognized, with the attributes and incidents of titles or evidence of just ownership or possession—inchoate, legal, or equitable—which inhere in the property, follow it, and form a component part of it wherever found. The fact that the ownership, interest, or title of a non-resident, as, for example, a bond and mortgage title to his debtor's property in another state or country, can be extinguished in the real and personal property of the debtor, by attachment or other process of law in the state where the debtor resides, and where his visible, tangible property has a *situs*, also leads up to and establishes as a principle of law *that titles or incumbrances are connected with the owner, but inhere in the property, where the property is actually situated, as incidents, form a part and are inseparable from it, and include the equitable title or right of the creditor in the debtor's unsold and unincumbered property, but are not themselves property.* Some economists befog themselves on this subject, as before shown, by first defining property as anything that can be bought and sold, and then, since a title—as, for example, a deed—can be bought and sold, accept the inference that a title is necessarily property. But let us analyze this definition and assumption. The creditor can, without doubt, sell and deliver a deed to a farm, but what is sold in such instances is the farm, including a right—namely, a right to have dominion over it. But it may be rejoined that a right of dominion is property. Let us, therefore, carry the analysis a little further. If a farm in California is property in the State where it is and where it is taxed, any right or title to the same farm, held in New York or England, be it in the nature of a deed, a mortgage, a partnership interest, or any other form of title, can not be the property; for the same thing certainly can not be property in two separate States and jurisdictions, and in two distinct forms and manifestations, at the

same time. On the other hand, if it be assumed that the title to the farm is the property, and, as such, can be rightfully taxed where it (the title) is, then it stands to reason that the subject of the title, the farm in California, ought not to be also regarded as property and taxed in New York or England. In other words, if the title to the farm is property, then the farm is not really in California at all (unless the owner of the title resides there), but goes out of that State in the pocket of the individual who walks off with the title to it. We have all heard of such a concentration of meat that all that is valuable in an ox for food can be put into a quart can; but such a concentration of property as is here supposed is something much more remarkable; and admits of a man having a drove of oxen in his hand, ten acres of woodland in his hat, a church with a steeple in one coat pocket, and a four-story brick block and a mill privilege in the other.

TO THE READER.—As the promulgation of ideas that are not in harmony with long-accepted lines of thought generally provokes controversy and expressions of dissent, which in turn often result in promoting self-education, the author, with a view of furthering such a result, would here ask attention to two letters, voluntarily written, when his views respecting the relations of titles to property were originally advanced by him (some years since) as a contribution to economic science; the *first* written by an eminent professor in one of the leading colleges of New England; and the *second* by an eminent merchant of New York, whose knowledge of economics was mainly the result of a long experience in practical business and financial transactions of great magnitude.

NO. 1. "MY DEAR MR. WELLS:

"You are misled by the term titles, and are not only wrong, but, what is worse, are wrong in a superficial way.

"The real question relates to the nature of credit.

"I buy a piece of land for five hundred dollars and give my simple note for value received. The title to my land is my deed. My note has thereafter no connection whatsoever with the land, but it has value nevertheless. The bank buys it as a piece of property and holds it till maturity for the sake of the difference between its face and its price—i. e., for the discount. Your philosophy does not account for this proceeding; mine does.

"Your assertion is that things of value must have a 'physical quality.' I deny that utterly; *nothing* has value by means of a mere physical quality. Does not my annual service to the college have a value? I get, at any rate, twenty-five hundred dollars a year for it. I render no 'physical quality' whatsoever.

"My note is worth nearly or quite five hundred dollars, but it is not a title to anything; it is a claim *on me*. So are all credits—claims merely, not titles at all.

"You say if such things are value we might multiply values indefinitely. No; because we can not sell them indefinitely. So far as we can sell we make values. Even land and merchandise won't sell notes, with all their physical quality. Physical quality has nothing to do with it. The only possible test of property is sale. The reason why credits are more limited in their use than commodities and services is simply that they relate to *future time*, which is less certain than past and present time.

"Yours truly, ————."

With a desire to obtain an opinion on this interesting economic question from the merchant, the foregoing note was referred to his consideration by permission, and elicited from him the following rejoinder:

No. 2. "Professor — seems to ignore the fact that debtors hold all their property which is not mortgaged or incumbered, as trustees to pay their creditors generally, and it is this same principle which gives value to unsecured credits.

"But the professor says, 'So far as we can sell we make values.' Does he mean that a counterfeited which is so good that it can be sold is a creation of value? Would a credit sell at all if it was not an inchoate right to the unsold and unincumbered property of the debtor? Of what value is a claim on a man if the claimant has no rights on the debtor's property? Such a claim would be no better than a claim on the northeast wind."

It is also important to note that while a deed to realty, properly executed and recorded, is regarded as the highest form of title, we have the decision of the United States Supreme Court (*Fletcher vs. Peck*, 6 Cranch, 87) that a deed is but an "executed contract" on the part of the grantor, not to resume the right in the thing granted; and if, therefore, a State can tax extraterritorial contracts, it may tax her citizens on deeds of land in other States.

This analysis of the meaning of property, from both an economic and legal point of view might be prosecuted with interest and profit to a much greater extent; but from what has been presented it would seem clear that nothing can not be something; or, in other words, that *property is always a physical actuality*, which has become valuable or property by some form of labor, and can not be created by mere paper documents, except to the extent of the value of the paper and the writing or printing upon it. Or, in other words, a title to property, a representative of property, can no more be property than a shadow can be a substance: and if this conclusion be true, then it would seem to follow, of necessity, that the act of making debts, bonds, verbal or written contracts, notes, book accounts, mortgages, warehouse receipts, titles, certificates of stock, or any form of salable or transferable rights, is not a creation or production of any new property, but simply an exchange, by contract or operation of law, of the rights and titles of parties in pre-existing property; and that any tax on any of these rights or titles is only another form of burdening the property which is the subject of the rights or titles. But some, in answer to the assertion that rights, debts, and titles are not property, for if they were we might make property by making rights and titles, might reply, "But we do make property in that way every day." But we can not do this indefinitely because we can not sell the title indefinitely; and why not? Let us, therefore, stop and think about it, and ask ourselves why we can not sell titles and credits indefinitely. We can sell property in the sense of embodied labor indefinitely. Why not titles and credits? The answer is simply that when we buy a title or credit we pay for and in a legal and economic effect buy the physical actuality, or right of dominion over it, which the credit or title represents, and nothing more. The moment one undertakes to sell titles

or credits in excess of or separate from the embodied labor they are supposed to represent, we call the act swindling. Fancy a member of the legal profession appearing in court to defend such a person for selling a title, separate from an actuality, on the ground that such a title was property because he was able to sell it, and that somebody not keen was persuaded to buy it! Would the plea *caveat emptor* avail in such a transaction?

In other words, when the title does *not* inhere in the physical actuality, we give it a bad name, and the most imaginative do not call it property. A title which is really a title is never suspended or in abeyance. If a thing is embodied labor, some one, or a number of persons, has some form of title or dominion over it, and the title is inseparably allied to the thing; and therefore the sale of the title is the sale of the thing, because they are one and inseparable. Embodied labor, therefore, embodies all forms of title to the embodied labor. Credits and titles of themselves have no value, and separated from the things they represent, they can not honestly be sold at all. Who will buy them? We know the character of the men who will sell them, and their representatives will always be found in penal institutions.

If some other name be given to embodied labor than *property*, it will not diminish its power to satisfy human wants; and if, on the other hand, we call credits and titles property, they can not be eaten, or made of themselves in any form to satisfy wants, but they can represent things which will satisfy wants. It is interesting also to note that when attempts have been made to claim salvage for the recovery of bills of exchange, or other titles of property, from wrecks, the courts have decided that salvage in such cases is not allowable; and, therefore, have practically held that credits and titles are not property, but mere rights to property, and in the case of negotiable instruments, when destroyed by fire or otherwise, the right under the destroyed instrument still remains, and can be enforced in courts when identified.

ACTUALITIES, NOT FICTIONS, THE LEGITIMATE SUBJECT OF TAXATION.—Enact such laws, also, in respect to taxing titles as we may, experience will prove that taxes can not be practically levied on imaginary things, or legal fictions, because it is some physical actuality, in the sense of embodied labor, that must, after all, and in the end, pay all taxes. Also, "taxes are generally demanded in money, and any tax law will be understood to require money when a different intent is not expressed" (Judge T. M. Cooley). If legislatures have the power of creating *fiat* property—that is, imaginary or fictitious property—it is beyond their power to make it pay taxes, for nothing less than omnipotence can make something out of nothing.

On the other hand, let us consider for a moment the converse of this proposition—namely, *that titles are property, and, as such, ought not to be exempt from taxation.* If this is so, then it would seem to follow that, by making titles, we can make property; and that when a man mortgages his farm for ten thousand dollars, the community have ten thousand dollars' worth of real estate and ten thousand dollars' worth of personal property, where, before the execution of the mortgage, there was only the specified value of the real estate. On the other hand, when the mortgage is paid off, ten thousand dollars' worth of personal property is destroyed, and by a parity of reasoning the State must be to that extent the poorer. A clear comprehension, then, of the facts, that property is embodied labor; that property can alone suffice to pay taxes; that rights, titles, and credits are but the representatives of property; and that, having subjected the property to taxation, there is no sense or equity in again assessing its representative, will at once divest the problem of taxation from many embarrassments which now seem to invest it, greatly simplify it, and go far toward the determination of sound and fixed tax principles.

Important decisions touching the question here under consideration that have recently been rendered by courts of high repute are also here worthy of notice. Thus, in California, the Supreme Court of the State has had before it the vexed question of taxation of mortgages, and the judges have decided, in accordance with justice and common sense, that, as mortgages do not in any way increase the body of wealth in a community, any tax laid upon them is laid upon a fictitious value; is in so far an imposition upon the taxpayer, and, inasmuch as it represents a second tax on real estate already taxed in the hands of the owner, is "double" taxation within the meaning of that term in the Constitution of California and other States.

In 1875 the following case came before the Supreme Court of New York (General Term) under the following circumstances: The administrators of a citizen being taxed by the proper tax authorities of the State for a large amount of personal property, put in a schedule of personal assets consisting mainly of certificates of stock in various railroad and mining companies, with a plea for abatement. The court, after consideration, through Noah Davis, P. J., rendered the following decision: "We are of the opinion also that the commissioners erred in including in their assessment the stocks of corporations created by and under the laws of other States. Such corporations are taxable, and we must presume, in the absence of proof, that taxes in their respective home States are duly assessed and collected upon their capital stock or property. The stocks in

such corporations, held by individuals here, are simply representatives of capital or property employed in business in other States, the title of which is vested in and controlled by the artificial person created by and residing in such States. They represent an interest which is or may become a membership in the corporation and evidence of a right to participate in divided profits and in the ultimate dividend of surplus after the payment of debts and obligations of the corporation. The stock certificates are not themselves the property, but are evidences of the rights just mentioned; to be possessed, enjoyed, and enforced under and in conformity with the laws of the State which created the body corporate."

The views thus expressed respecting the inconsistency and undesirability of directly taxing titles, credits, obligations of indebtedness, and instrumentalities of exchange are so generally and thoroughly accepted by the statesmen, financiers, and economists of Europe, that no recognition of this form of taxation can, it is believed, be found in any of their fiscal systems. In England the very idea would be scouted; and in France, where the need of great revenues is most imperative, and resort has been had to almost every other device and expedient for collecting contributions from its people, the taxation of titles and credits has never been contemplated. Some years since (1879), when the State of California adopted a new Constitution, and, in virtue of the statutes subsequently enacted under it, made subject to additional taxation bonds, moneys, promissory notes, certificates of indebtedness, and shares of stock in corporations otherwise taxed, the utter absurdity of such action was thus strikingly demonstrated in one of the San Francisco papers by the following humorous illustrations:

"A has a horse; B has nothing, but is honest and industrious. B buys A's horse and gives his promissory note for one hundred dollars. The horse previously taxed as property in A's hands is now taxed as property in B's hands, and A is taxed—just as much as he was before—on B's note, which is property also. That is to say, the new Constitution holds that by a mere stroke of his pen, B, who has nothing, and can give himself nothing, can instantaneously create as much property for others as others may happen to think that he will some day be able to acquire. Truly the performance of the man who causes two trees to grow where but one grew before is of so little comparative benefit that he might be justly censured for a sin of omission.

"Let us suppose that B had given not a written but an oral promise. Ought not A to be taxed on that? If not, *why* not? Because an oral promise is not an evidence of debt? not a 'credit'?"* But how if there were witnesses? Oral promises *are* credits, however; nay, even implied promises are. You have to pay—the courts will make you pay—your tradesman's account whether you have ever passed your word or not.

* Promises, according to Professor McLeod, are property.

"Now a 'credit,' be it promissory note, mortgage, certificate of deposit, or what you will, is not only not property, but is proof that the holder has parted with property that he once had. His paper credits, which merely certify that in consideration of certain advantages (interest, freedom from cares of management, etc.) he has surrendered his property to another, have no function but that of enabling him at some future time not to resume his own, for it is no longer his, but to acquire its equivalent from the present owner. The more a man has of these things, which it is proposed to tax as property, the poorer he is—not necessarily poorer than a man with none, but poorer than himself was before he got them. It is only by surrendering them that he can become again as wealthy as he was.

"Is he then to escape taxation, living at his ease on his interest, while the man who pays it bears the expense of government for both? Let us see if under the present system the latter does anything of the kind. X wants a thousand dollars of Z, for which he can afford to pay, say, sixty dollars a year. But if the State government is going to exact from him ten dollars, he can afford to give Z but fifty, with which that person must be content, or X will either get the money from another or not take it at all. It is clear, therefore, that the lender really pays the tax, the borrower being unaffected directly; what he pays to the State he would otherwise have to pay to the lender. Indirectly he is affected thus: Taxation of the principal, by reducing the interest, reduces also the volume of borrowable money by driving a part of it into more profitable investment, and the scarcity so created tends to restore the rate of interest, the cause thus counteracting its own effect, as the slackening in the speed of a steam engine is the agent that increases its velocity.

"Reverting to the matter of the horse, we find that quadruped in the possession of B and a note for one hundred dollars in the hands of A. Relying on B's payment of the note, A purchases a hundred dollars' worth of flour from C, giving *his* note. C knows that A is good for the amount, and gives his own note for a hundred dollars for a barrel of whisky to D, who then feels rich enough to purchase a thousand cigars, at ten dollars a hundred, from E, satisfying him with a note. At the end of a month D's hospitable friends have burned all that gentleman's cigars; C, in one protracted, solitary revel, has gone through his barrel of whisky like a rat through a water pipe; A's family and retainers have consumed his flour like a flame in flax; and B's charger, broken by the weight of the financial superstructure reared upon his patient person, lies deadwise on the plain, with daisies at his head and at his feet. But he has left a legacy of taxable 'solvent credits' that does honor to his memory better than a monument of brass, and

" 'Nothing beside remains round that colossal wreck!'

"Working for a dead horse is, however, proverbially disheartening, and it is some years before B has put by enough money to discharge his debt to A, and has thereby rendered him unable to pay C, whose habit of being supinely drunk has made the expensively befriended D whistle in vain for the wherewithal to pay E. But finally B hands a hundred dollars to A, who hands it to C, who hands it to D, who hands it to E; and four hundred dollars' worth of taxable property, on which the government of this State had been living, like St. Simon Stylites on his capital, vanishes into

thin air ; for the notes go to the kitchen stove, and the new Constitution made no provision for taxing the ashes.

"Charles Young takes a pig in payment for his paper—like for like. Being a Jew, Mr. Young has conscientious scruples against eating pork, so he sells his pig to a butcher, taking his note. The butcher, finding the animal more than usually intelligent, thinks it would be wrong to hide the light of its political sagacity under a bushel of salt, and sells it alive to Clitus Barbour to represent that statesman, who helped to launch the new Constitution. Clitus gives his note for the pig. Becoming jealous of its rivalry, he sells it to Governor Kearney (taking his note), whose parlor it graces for a season, but, being detected in an indiscretion, the Governor sells it to General Howard, who gives his note. General Howard wants this pig to write letters favoring the new Constitution ; but, as it scorns to prostitute its intellect that way, its less scrupulous owner parts with it to the congregation of Metropolitan Temple, whose pulpit it now fills, they giving their note and a benediction.

"The foregoing pig is now represented by five promissory notes and a benediction not taxed. None of these notes bear interest, nor are they of any benefit to their holders except as they may enable them, at a stated time, to get something of the same value as something previously renounced. The various notes make a trail of papers like that left by the 'hare' in the boys' game of 'hare and hounds.' Now comes the assessor under the new Constitution, and, in obedience to a righteous provision taxing property used for religious purposes, assesses that porker in the bosom of the church. Then he strikes the paper trail extending out through secular spaces into an editorial office, and, having assessed the grunter where it is, he again assesses it where it was last, and again where it was the time before, and so on through the whole series, until that not very valuable fitch of bacon, which has 'dragged at each remove a lengthening chain' of 'solvent credits,' has been the innocent cause of six payments into the State treasury. Beyond Mr. Young the assessor does not trouble himself to go, for on the ranch of a granger who is so intelligent as to exchange pigs for his papers the pachyderm's trail consists of tracks in the mud, and these the new Constitution neglected to declare to be property."

MONEY PROPERTY.—But, after all, says some objector, "notwithstanding your many and plausible arguments—your statement that all the world except the United States have done away with the old, atomic, inquisitorial system of taxation—I do not like your proposed reforms, and for the reason mainly that they exempt 'money property!'" It is most important, therefore, to inquire what is "money property," and also its relations to local taxation.

All capital or property is accumulated labor, labor being the source of all property. Hence any attempt to excite prejudice against capital or property, or to attack either, is an attack upon labor itself.

"Moneyed property" is generally understood to mean *evidences of debt*, which are not in a strict sense property; but *rights to property*, or *assignments of property*, according to the amount of interest of the creditor.

WHAT IS A MORTGAGE?—A mortgage may be defined to be a species of conveyance of property—mainly real estate—for the security of a debt, generally created by a loan of money, and can not be regarded as a *complete*, but rather a *conditional* or *quasi-title* of the property covered by the conveyance. It is not so much property as a deed; and neither is property except to the extent of the value of the paper and the labor of writing or printing it, and still both are very valuable as conveying rights to property. The property is the real estate conveyed or mortgaged, and a tax on the land and another tax on the deed, or a tax on the land and another tax on the mortgage which covers the land, will in effect be a double tax on the land. This tax may be made a quadruple tax: first on the land, then on the deed of the land, then on the mortgage which is on the land, and then on the lease which the landlord may grant to the tenant.

The following curious instance of hardship in taxing mortgages actually occurred in one of the counties of central New York under the existing system: A worthy farmer and his wife, finding themselves becoming incapacitated through age from taking practical care of their little farm, sold it for five thousand dollars, and allowed the purchase money to remain in the form of a mortgage, with the expectation of living on the interest paid annually by the purchaser from the profits of the farm. The town being very small, the fact of the sale and the consideration paid became known to every one, and the assessors were compelled, in opposition to their usual practice, to tax the old man to the full amount of the mortgage, as personal property. But the year in which this was done happened to be a year in which the town, anxious to avoid a draft of men for the army, to which the old man was not liable, put up the rate of taxation to more than the legal rate of interest, in order to provide sufficient money to purchase recruits. The result was that the poor old man and his wife found that not only was all their income from the mortgage swept away by the tax collector, but they were even obliged to go out for days' work, in order to pay a balance of taxation and provide means of support; and this, too, while the identical farm for which the mortgage was given was taxed at one fifth its true value, and other investments of other citizens of an invisible and intangible character undoubtedly escaped taxation altogether. And this we call equality in taxation.

TO TAX INDEBTEDNESS IS TO TAX THE BORROWER.—If any one doubts that a tax on indebtedness is a tax upon the borrower, or the property which the indebtedness covers, that question can be easily solved by an *honest, uniform* tax on all State, county, town, and city

bonds hereafter issued, by making them all subject to an annual tax of one, two, or more per cent, and by providing that the tax shall be deducted at the time of the payment of the interest. Is there any one who believes that these bonds will sell in the market at the same high rate that they would command if by law they were free from taxation?

We can also test the effect of an honest, uniform tax upon mortgages by providing that mortgages hereafter made shall operate to reduce for assessment the valuation of the land mortgaged to the amount of the mortgage, and that the mortgagor shall pay the tax on the mortgage, and deduct the tax from the principal or interest, when paid to the mortgagee. But who believes, under such a law, that any money would be loaned at the legal rate of interest?

A somewhat curious piece of practical evidence, in support of the truth of the above position, in respect to the taxation of mortgages, has been afforded by an experience of New Jersey. This State exempted, in 1869, all mortgages from taxation in certain of her counties and cities which lie contiguous to New York city; but this legislation, although operating to draw capital away from New York and into New Jersey, was not primarily effected for any such reason, but was brought about in this wise: New Jersey, in the first instance, enacted an honest, uniform law of taxing mortgages, and one, moreover, which could with the utmost certainty be executed, and similar in principle to that above suggested; namely, that the person giving the mortgage should pay the tax on it, and deduct the tax from the principal or interest in settling with the creditor. The result was that all mortgages falling due were immediately foreclosed, and as no new loans, moreover, could be made, the inhabitants of the growing counties near the city of New York, wishing to borrow money on land, or to sell land, found themselves in an uncomfortable position; so much so, that if the law taxing mortgages in this section of New Jersey had not been promptly repealed by the Legislature, the issue would soon have become a predominant one in the State elections; and hence the explanation of one of the most curious statutes in the history of American legislation which made one tax law for one part of the State and another and a different one for the remainder.* But the point of chief interest in respect to this whole tax experience to which attention should be especially direct-

* "And all mortgages upon estates, chattels, or personal property, taxable by law within said counties of Hudson, Union, Essex, and the city of Brunswick, Middlesex County, and the county of Passaic, except the townships of West Milford, Pompton, and Wayne, for State, county, township, and city purposes, shall be exempt from taxation when in the hands of any inhabitant, corporation, or association residing or located in said counties or cities." (Approved April 2, 1869).—*Laws of New Jersey, 1869, p. 1225.*

ed, is, that it did not take the citizens of New Jersey a great length of time to find out that a borrower of money on a mortgage paid the tax, and that the lender was the tax collector, and only paid his part of a diffused tax, as all other persons living, consuming, buying, or selling in the State must pay; and that if the borrower could not legally pay the lender a rate equal to other net profits of investments, he could not borrow. A little experimental legislation in other States will, therefore, effectually explode the vague theory that taxes *uniformly* levied do not diffuse themselves; and although it is true that the persons or property primarily taxed do not charge the entire tax over to others, this very fact nevertheless shows that the tax is diffused with *absolute equality* upon the persons who originally may pay the tax, and upon those who finally bear their portion of it.

LOANS ON MORTGAGES PROHIBITED IN ROME.—Mommson, in his History of Rome, states that at one period the lending of money in that country on mortgages was prohibited, and it is apparent that a uniform taxation of mortgages would amount to a prohibition as effectual as the prohibition which existed under the Roman law. The Roman patricians, in their legislation, wished to prevent the common people from becoming an independent yeomanry, and owning and acquiring real estate through the facilities of borrowing upon mortgages. No chimerical attempt had then ever been made to tax money at interest, and this purpose of having the soil cultivated on shares or by dependent tenants could best be obtained by a prohibition of all mortgages.

Now, it needs no argument to show that a system of onerous taxation of mortgages must have a tendency to re-enact the Roman policy, and that it is undoubtedly the true interest of the state, on both political and economical grounds, to encourage occupiers to become owners, who always give better attention and protection to their own property than to the property of landlords.

PURCHASERS OF GOVERNMENT BONDS NOT PRACTICALLY EXEMPT FROM TAXATION.—The purchasers of United States, State, and municipal bonds or securities, which are nominally exempt from taxation, are in effect taxed, and uniformly taxed in the high price which they are obliged to pay for these securities by reason of their exemption from taxation. It is not only a sound principle of political economy that a tax upon money at interest is simply a tax upon the borrowing price of the borrower, causing an increased rate of interest, or a reduced price to be obtained for the obligation given; but this principle has been adjudicated by the highest court of the country, so far as a court of last resort can adjudicate a great principle in economic science. Thus, in the case of *Weston vs. The City of Charleston* (2 Peters, 449), the Supreme Court of the United States, through

Chief-Justice Marshall, held that "*a tax on Government stock is a tax on the power to borrow money on the credit of the United States.*" If, therefore, we except the borrower from taxation in the form of a decreased rate of interest, we grant him no special exemption or advantage, for his property, which is covered by the debt, has already in other forms been taxed, and the exemption will diffuse itself in the form of lower rate of interest, which will be the means of producing a higher price of labor, land, and personal property, until the exemption is completely diffused. Who will then be injured by taking the tax from money at interest? It is probable that he who now adds the tax to the rate of interest, and charges the borrower, and does not pay it to the State, may lose by the change. He will be obliged to enter the open money market and pay the market rate, as the purchasers of Government bonds now do, for evidences of debt that will be free from taxation in the hands of all persons; and the laws of trade will regulate his investment as they daily regulate the price of Government bonds, and will bring down his securities to a rate of interest not much above the rate paid by the national Government. The exemption applied to United States bonds, which is of no practical benefit to the present purchasers, in consequence of the increased price of the bonds, would be of no benefit if applied to the holder of other securities in an established and permanent system, except in freedom from the uncertainties and irregularities attending the exercise of arbitrary and irregular power. If the exemption is an exemption of everything of the same class, it is perfectly equal and fair, and its effect is diffused and equated; and the tax on another article, taxed in lieu of the exempted class of articles, is likewise equated and diffused, and if invisible and imponderable evidences of debt can not be taxed equally no injustice will arise if they are all free from primary taxation, and if the taxes of a permanent system are imposed on other things subject to positive and fixed rules of assessment. The daily price of United States bonds, therefore, is a constant lesson that an exemption of a security from taxation is an exemption of the borrower, and the same law of political economy will rule in respect to both private and public debts. Each State has, therefore, the power to put its borrowers on an equal footing with the General Government, and without injustice or inequality toward the borrower or the lender.

THE OLD AND NEW IDEAS IN TAXATION.—The first attempt made to tax money at interest was instigated against money lenders because they were Jews; but the Jew was sufficiently shrewd to charge the full tax over to the Christian borrower, including a percentage for annoyance and risk; and now most Christian countries, as the result of

early experience, compel or permit the Jew to enter the money market, and submit, without let or hindrance, his transactions to the "higher law" of trade and political economy. But a class yet exist who would persecute a Jew if he is a money lender, and they regret that the good old times of roasting him have passed away. They take delight in applying against him, in taxation, rules of evidence admissible in no court since witches have ceased to be tried and condemned. They sigh at the suggestion that all inquisitions shall be abolished; they consider oaths, the rack, the iron boot, and the thumbscrew as the visible manifestations of equality. They would tax primarily everything to the lowest atom; first for national purposes, and then for State and local purposes, through separate boards of assessors. They would require every other man to be an assessor or collector, and it is not probable that the work could then be accomplished with accuracy. The average consumption of every adult inhabitant of the United States is at least two hundred dollars annually, or in the aggregate \$1,500,000,000; and this immense amount would fail to be taxed if the assessment was made at the end of the year, and not daily, as fast as consumption followed production. All this complicated machinery of infinitesimal taxation and mediæval inquisition is to be brought into requisition for the purpose of taxing "money property," which is nothing but a myth. The money lender parts with his property to the borrower, who puts it in the form of new buildings, or other improvements, upon which he pays a tax. Is not one assessment on the same property sufficient? But if you insist upon another assessment on the money lender, it requires no prophetic power to predict that he will add the tax in his transactions with the borrower. If a tax of ten per cent was levied and enforced on every bill of goods, or note given for goods, the tax would be added to the price of goods, and how would this form of tax be different from the tax on the goods?

"Money property," except in coin, is imaginary, and can not exist. There are rights to property of great value. The right to inherit property is valuable; and a mortgage on land is a certificate of right or interest in the property, but it is not the property. Land under lease is as much "money property" as a mortgage on the same land; both will yield an income of money. Labor will command money, and is a valuable power to acquire property, but is not property. If we could make property by making debts, it can not be doubted that a national debt would be a national blessing. Attacking the bugbear of "money property" is an assault on all property; for "money property" is the mere representative of property. If we tax the representative, the tax must fall upon the thing represented.

FEET AND HANDS.

By M. BERNARD (MRS. HENRY BERNARD).

II.

IN our last paper we described the feet of some of the chief groups of four-footed animals. We saw that in most of these animals the four feet are very much alike, because they all have the same kind of work to do—that is, walking or running. But when, in consequence of its manner of life, an animal comes to use its fore feet differently from its hind feet, as the kangaroo does, we find that a difference arises in the structure of the two. We now have to trace some of the more marked changes of this kind.

So far, all the animals we have mentioned have been land animals, all needing their feet for moving in one way or another on the ground. But, ages ago, some land animals changed their manner of life and took to living chiefly in the water, only occasionally coming on to the land, or even merely coming to the surface of the water when they were obliged to breathe, for they still had lungs, which needed to breathe air. To such animals (for example, seals and whales) ordinary feet were partially or altogether useless; they had chiefly to paddle or swim, seldom or never to walk, and, to enable them to hold their own against their water enemies, their limbs gradually became very much changed.

Taking first the seal, which even now climbs on to the land, we see all the four feet changed into paddles, but these paddles, being still occasionally needed for use on land, are not very unlike the feet of an ordinary land animal. In Fig. 1 we see that the fore foot of the seal (A) bears a considerable resemblance to his hind foot (B); there is some difference in length and in the posi-

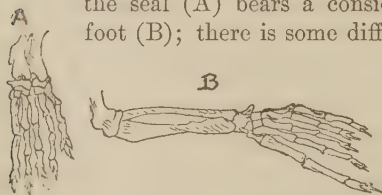


FIG. 1.



FIG. 2.

tion on the body, for the hind limbs face each other at the back of the body, but all four are paddles.

Taking next the whale, which has entirely given up coming on to the land, we find only one pair of paddles or changed feet. When the land ancestors of the whale took to living in the water, they probably had tails, which, by whipping the water, helped them to swim, and they evidently learned to wave the hinder part of the body

in the water as a fish does to help to push him along. They did not use their hind limbs at all for this purpose, and these, like all unused parts of the body, diminished in size and strength. In the whales now existing no hind limbs are to be seen, but traces of the skeleton of the hind limbs are still found imbedded in the sides of the fishlike body. How small these remains of the former leg are in comparison with the constantly used front foot, now a paddle, may be seen from Fig. 2 A and B.

Again, ages ago, other land animals managed to raise themselves from the ground into the air, the better, no doubt, on the one hand, to escape from pursuing enemies, and, on the other, to catch flying insects. For supporting themselves in the air, wings of some sort were necessary, and so the front legs in such animals gradually altered.

Although none of these first flying animals are now in existence, we know pretty well what they were like, as impressions of their bodies have been left upon slatelike rocks. They were animals in many ways like reptiles—i. e., belonging to the same group as the crocodile, whose five-toed fore foot was illustrated in our first paper.

In some of these first fliers all the five toes were retained; four were of ordinary length, but the fifth was immensely long—longer, in fact, than the whole body of the animal—and between it and the body a skin was stretched, making a wing.

Here we have somewhat the same method of flying as we now find in the bat. In a bat's outspread wing (Fig. 3 A) the five rays of the fore foot are quite clear. Four of them are joined together by thin skin which stretches back to the leg and the tail. The lower part of the arm and three of the rays which carry the flying skin are greatly lengthened, and so a very large wing is obtained. The first ray, which we might call the thumb, remains short and ends in a strong claw that is of use in climbing.

We thus, in the bat, have an animal with the fore foot extraordinarily changed to suit it for a special manner of life—i. e., for flying. The hind foot (Fig. 3 B), not having any new kind of work to do, is much less changed. It has five ordinary toes ending in claws, with which the bat climbs or hangs on to trees. So well fitted are the hind feet for this kind of work that many bats always sleep wrapped up in their wings as in a mantle, hanging on to the branch of a tree, head downward.

But not all of the first flying reptiles developed wings of stretched skin. Some came to fly by means of feathered wings not unlike those of birds. Fig. 4 shows the bones of the fore foot or wing of a small creature called the *Archæopteryx*, or first feathered flier. This animal had three distinct toes, each ending in a claw. Two toes had thus already been lost, the fourth and fifth, which also are

never found in any bird. The feathers of this creature grew out of the skin of the arm and of the third finger.

In the fowl (Fig. 5) and all other birds the wing is, as in the *Archæopteryx*, a feathered fore leg and foot. A, B, C, in Fig. 5, are the leg bones, and the rest represents the foot, which retains in part the three rays seen in the *Archæopteryx*. Two of these rays, however (1 and 3), instead of having several joints, are nothing more than short, pointed bones. U C and R C are the only bones of the "wrist" left, and MC II and MC III show all that remains of the bones



FIG. 3.



FIG. 4.

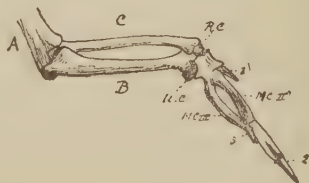


FIG. 5.

which in a four-footed sole-walker form the flat of the foot. 1 is the remains of the first toe or digit, 2 is the long second digit, which still has three joints, and 3 is the one remaining joint of the third digit, which is not distinctly separated from the second. All the other parts of the lizardlike fore foot have disappeared, because this was quite enough to serve as a rigid support for the skin which carries the feathers.

The domestic fowl, of course, uses its wings very little; it walks more than it flies. Most birds use their wings much more, and some of these have more of the bones of the original foot left. Other birds fly still less than the fowl. The penguin, for example, uses its wings not for flying but for swimming, and the bones have become much flatter and broader than those of ordinary birds. The feathers that cover them are exceedingly small, almost more like scales than feathers, so that the whole wing is flat and paddlelike, and is very suitable for acting as an oar in the water.

In some of the ostriches, which also never fly, the bones which support the wing are reduced to mere stumps, even the second digit having only one joint.

The hind feet of birds are less changed than the fore feet, but still differ from the lizardlike foot in the number and character of their toes. Some birds have four toes, others only three, and these toes are usually able to curve so as to grasp the branches of trees, and are armed with claws which help in climbing. In the birds which run along the ground instead of flying, like the ostrich, there are usually only two toes, which become very much thickened. Here, as in the horse, we find increased speed in running obtained by reduction of the number of toes. The horse, as we saw, actually has only one toe, and in some ostriches the second toe is so reduced that they practically have only one also.

Great as is the difference between the fore and hind limbs of the bird, that between our own hands and feet is quite as important. The fore feet of all animals have sometimes been called "hands," to mark the fact that they correspond with what in a human being is the hand, but in the animals we have considered we have had nothing like a hand in the true sense of the word. In a true hand, the inner finger is able to move in such a way as to face the other fingers, and the hand is thus able to grasp any object far more firmly than if the movement of all the fingers was similar, as it is in the foot. Such an inner finger is called an opposable thumb, and its presence is absolutely necessary to a real hand.

Let us see if we can understand how such true hands arose. Besides the animals which run about in various ways on the ground, those that have taken to living in water and those that have learned to fly in the air, there are others that live almost entirely in trees, climbing or springing from branch to branch, and only occasionally walking on the ground. These animals, the monkeys, which feed principally on the fruits that grow on the trees they inhabit, need agility in climbing rather than swiftness in running, both for obtaining their food and for escaping from their enemies, and so all their feet have become specially adapted for firmly grasping the branches of trees—i. e., they developed thumbs on all their feet; for this reason they have been called the *Quadrumana*, or four-handed animals.

If we examine the hand and foot of a gorilla, given in Fig. 6 A and B, we shall notice that the hand (A) differs very little from the hand of man, given in Fig. 7 A. The feet of the ape, however, differ considerably from those of man (cf. Fig. 6 B with Fig. 7 B).

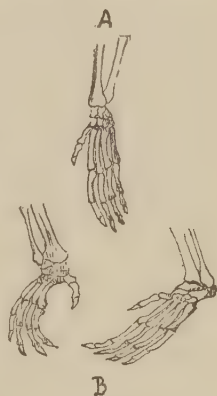


FIG. 6.

There is no doubt that the very earliest men spent their lives much as monkeys now do. They probably lived partly in trees before they learned how to build houses in which they could take shelter from bad weather and when threatened by animals that were much stronger and could run far more swiftly than they. Thus our hands were once developed for climbing about trees, and since that time have changed very little in shape. As man became civilized, his hands were put to nobler uses; they were his best instruments for accomplishing all he achieved. Our hands are thus much more flexible and capable of a far greater variety of movements than the hands of the less civilized monkey.

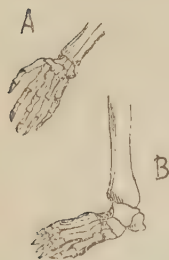


FIG. 7.

The hind foot of the monkey was not well suited for man's way of life. One great difference between man and the monkeys is that man walks and runs in an upright position on his hind feet alone, while even the most manlike of the apes walk only partly upright, not supported entirely by their feet but helped along by their hands, which, on account of the great length of the arms, can easily reach the ground. In a man, walking upright, the weight of the body is thrown entirely on the hind limbs, which in him become the lower limbs, and the feet are needed to form a firm pedestal for the whole upright body. Thus in man, the once climbing feet having given up climbing, the useless thumb gradually changed back again into a simple great toe, and the first joints of the rays lengthened out to form a firm flat sole. We can still see some signs of the former thumblike condition of the great toe in little children and in some foreign races. In babies, the great toe is often more or less opposable to the others, and among the Japanese it is still so much so that a Japanese workwoman often holds the work she wants to stretch between her toes, which are able to grasp it firmly.

Men and women have, as a rule, five toes and five fingers, the largest number found in animals; but it is by no means certain that this number will always be retained. The foot of a civilized man is always covered by stockings and shoes, and the toes are hardly used at all, and, like the toes not used in the feet of animals, appear to be diminishing in size. The little toe in a comparatively large number of human beings already has only two joints, and some of the other toes also seem to be becoming shorter. It is thus quite possible that at some future time the human little toe will altogether disappear, and that man may have only four toes, or even, in course of time, fewer than four.

[Concluded.]

EDUCATION IN THE ANIMAL KINGDOM.

BY M. CHARLES LETOURNEAU.

LIKE man, animals, especially those of the higher orders, are born with a latent, inherited education, the effects of which are manifested in the course of individual development. Our organs, for instance, which have been slowly built up during the evolution of the various specific types, act of themselves, each in its own way. They have their own memory. The digestive, circulatory, and respiratory organs, the senses, etc., discharge their functions spontaneously and without waiting for lessons from any master. The young animal left to its own impulses usually comes very soon to take care of itself in the great world, to avoid its enemies, and find food and a comfortable bed. Except in species that live in larger or smaller societies, parents drive away their young as soon as they have arrived at a stage in which they can take care of themselves. This fact is easily observable in birds, even when they are domesticated. The solicitous care of turtledoves for their young gives way to pecking and wing striking as soon as the latter are developed. Eagles drive their grown-up young from the nest, and even from the neighborhood. Some other species take care for the future of their offspring, and before sending them away teach them to fly, or swim, or hunt, or fish. Dureau de la Malle saw falcons, high up in the air, drop dead mice and swallows in order to teach their young to spring upon their prey when in rapid flight, and to estimate distances; and when the little hawklets were somewhat larger, they dropped living birds instead of dead game. American crested ducks teach their young to find seeds and to snap at flies and aquatic insects.

It is generally the female that exercises this care for her offspring, while the male concerns himself little about the matter. The female wild duck leads her brood to the water, and takes care to choose places of no very great depth for this first lesson, and trains the little ones to hunt flies, mosquitoes, and beetles. The female of the eider duck gently carries her ducklings one by one in her beak, escorts them to the deep water, and teaches them to dive for fish. When they are tired she glides under them, takes them on her back, and carefully carries them to the shore. It is undoubtedly very largely by virtue of instinct and ancestral education that birds swim or fly, and the mother has only to invite them to the act by her example; but, for a more complete training, the lessons are very useful, if not necessary. These lessons given by the parent birds to their young are the more impressive because birds have a vocal language, developed to a certain extent, and the example is enforced by admonitions,

encouragements, reproaches, and appeals, calculated to stimulate the natural tendency to imitation. With some species of birds this language too is taught; the individuals collect every morning and evening in chattering groups, and the young, enjoying the benefit of a social conversation, easily learn to sing and chatter. Singing birds sometimes, too, give one another lessons without thinking of it. Some birds sing badly when they have grown up alone, without the fellowship of companions of their species; others readily learn the songs of strange species, and even of man. Dureau de la Malle taught a starling to whistle the Marseillaise, and the bird in turn taught its fellow starlings of the neighborhood. These abnormal acquisitions, however, have not the fixity of hereditary instincts, and are easily forgotten unless constant care is exercised to preserve them—being, in this respect, very much like what is learned in the schools for the examinations.

Numerous facts similar to those we have cited have been collected by naturalists, travelers, and observers concerning education among mammals. The mother bear, for example, takes great pains in the training of her cubs; she teaches them to walk, climb, and eat, and inflicts punishments in the shape of cuffs and bites to insure success; and the cubs never resist, even if they are larger and stronger than their mother. A female elephant has been seen giving swimming lessons to her calf, and correcting it when it blundered. Working animals instruct their young by associating them in their labors. A female beaver has been observed to cut down a willow, gnaw the bark, and trim off the branches, while her young imitated her, and finally helped her carry a limb to the water.

When lions were still numerous and easily observed in southern Africa, they were sometimes seen instructing one another in voluntary gymnastics, and practicing their leaps, making a bush play the part of the absent game. Moffat tells the story of a lion, which had missed a zebra by miscalculating the distance, repeating the jump several times for his own instruction; two of his comrades coming upon him while he was engaged in the exercise, he led them around the rock to show them how matters stood, and then, returning to the starting point, completed the lesson by making a final leap. The animals kept roaring during the whole of the curious scene, "talking together," as the native who watched them said. By the aid of individual training of this kind, industrial animals become apter as they grow older; old birds, for instance, constructing more artistic nests than young ones, and little mammals like mice becoming more adroit with age. Yet, however ancient in the life of the species these acquisitions may be, they have not the solidity of primordial instincts, and are lost rapidly if not used.

While among the mammals this business of training is usually intentional and a family matter, attended to by the mother, with such invertebrates as bees and ants, in which the females are simply egg-laying machines, the mother's educational function is null, and the care of the young rests with the sterile workers. Yet the mental side of the maternal function subsists in mother ants in a latent state, and virgin females have been seen, according to Huber, busying themselves with the eggs and the larvæ. But as a rule the training in the nest is a grand social affair, committed to the female workers, who devote themselves with complete abnegation to their task, and seem to enjoy themselves in performing it. When the young have gone through their metamorphoses, their nurses, now become instructors, keep with them, guiding them through the labyrinth of the city in all its windings; and this education is probably carried much further than observers are able to follow it, for the working ants must be trained for their duties. Their industry is too complicated to be purely mechanical and blindly instinctive as is often supposed. But the observation of this training requires distinctions between individual ants which the human eye is hardly competent to make. Among the slaveholding ants the education consists largely in transforming certain inveterate tendencies. They make war upon another species, the brown ants, capture their young, and bring them up to be their own slaves, in ignorance of the species to which they belong, and of its traits. An equivalent to this transforming tendency of education may be found among the vertebrates, where, if we take the young early enough, we can disturb their hereditary functional manifestations to a considerable extent. Young chickens, raised apart, do not learn to drink by filling their beak and raising their head, but plunge their bill into the full vessel. Newborn babes soon lose the faculty of sucking if they are fed with the spoon.

All this is because, notwithstanding morphological differences, all living beings have something in common at the bottom; so that the physiological psychology of one species may illustrate that of others, and even of man. In short, we have good grounds for saying that all animals, whether vertebrates or not, but possessing nervous centers, however little developed, are susceptible of education; with all a suitable training long enough continued can to a certain extent derange the hereditary tendencies which we call instinctive, and even create new ones. These perturbations, these metamorphoses of native tendencies, are observable with special ease in domestic animals. We have a right to be surprised that, after having so successfully adapted the few animals with which we are acquainted to his service and use, man has not tamed many others. We may suppose

theoretically, and it is made probable by numerous experiments, that there are few among the superior species that would resist a methodical and persistent training. It should be remarked that except the cat, which is largely indocile, most of our really domestic animals belong to social species which in the natural state lived in larger or smaller hordes or companies, and whose communal life had taught them to submit to the more or less despotic will of their stronger companions. But there are social species which man has not domesticated, and there are other species which only require a longer education. In fact, various solitary and ferocious animals, as the wolf, bear, lion, panther, etc., have more than once been tamed or broken in by special education; and during the prevalence of the amorous passion the females of the wildest animals permit themselves to be approached by man, and even ask to be caressed. Experience has shown that all training is relatively easy when addressed to the young. By judicious application to the business, by being severe or kind upon occasion, animals of the most ferocious species have been tamed. A panther has been taught to use its paws gently as a cat, simply by rewarding it with a little lavender water, the odor of which is delicious to it. But it should be said by way of caution that with animals as well as with man, a too brutal education destroys the character by developing a malicious cunning, only partly dissimulated by an apparent submission.

Vicious horses are generally the result of a violent, barbarous training, and when the greater number of the horses in any country are tricky and hard to manage, it means that they belong to a brutal population. From time immemorial the contrary has been the case among the Arabs, where colts are brought up and exercised with almost maternal solicitude. The child amuses itself by petting and playing with the colt of which he is some day to be the rider, and the horse and his cavalier grow up together. The earliest education of the young animal begins in the family, in the same tent. The colt is constantly looked after and caressed, and is never chastised except for acts of malice or disobedience. He is given the choicest dainties of food, and is gradually accustomed to make himself useful. When the bit is put in his mouth the iron is covered with wool, so that it shall not bruise his lips, the wool having been dipped in salt water to give it a pleasant flavor and make him like it. The animal's education is thus always carried on with constant discretion, and even after it is completed the trainers never indulge in blows or hard words. By such association a real bond of friendship is formed between the beast and his rider.

The art of falconry alone is enough to prove that it is possible by a proper mixture of severity and kindness to tame to a certain extent,

if not to render amiable, fierce animals of moderate intelligence; and the argument is of more force because the training in falconry was given to adult birds. Very little was done with birds taken from the nest. They were doubtless more readily taught, but became only indifferent hunters. The old books on falconry explain in great detail the methods of proceeding in training adult falcons or haggards; and some tell how one should keep them company and make friends with them.

When it comes to more intelligent animals, like the elephant and the dog, the process of education is much less awkward, but its nature is at bottom the same. Our dog has so long been the associate of man that we may truly say it is born domesticated, and nothing is left to be done but to train it for various useful purposes. But it is different with the elephant, which is captured wild and adult; and the processes to which recourse is had in training it are, therefore, of particular interest to us. If the education of the adult elephant can be effected without very great trouble and in a fairly short time, it is because we have to do with an intelligent and even reflecting animal, which holds an accurate recollection of events, and is capable of reasoning about them—which, in short, acts almost as a man would do.

As much might be said of some of the monkeys—of that chimpanzee, for example, which the French naval officer Grandpré saw on a ship working at the capstan, assisting in the management, stoking the furnace, etc.; or of those primates which are utilized at Sierra Leone for the performance of many labors of man. If the larger monkeys had been domesticated by man, and associated with him for thousands of years as the dog has been, it would not be unreasonable to suppose that they would have been still more modified, morally and physically, than that animal. They would probably have made a closer approach to the inferior human races; for the dog, different as he is from man, has been remarkably humanized by his contact. This mental humanization of the dog is an extremely important fact, as showing how powerful education may be; how, if time enough is taken, it may modify the organization. The domestic dog is evidently descended from one or several canidian ancestors similar to the wolf, very wild and not very intelligent, but endowed with a social instinct. Many centuries have been required to change it into the devoted companion and worshiper of man that it is, to acquire its expressive bark instead of the wolf's howling, and to assimilate the many qualities and capacities it exhibits so foreign to its nature. Its civilization has not taken place all at once. We still find half-wild dogs among the Australian hordes and other lower races, that do not know how to bark, that have no affectionate rela-

tions with their masters, and are nothing more than selfish auxiliaries in hunting or fierce sentries of the camp or village.

The qualities we prize in our domestic dog are those traits it has acquired by education, and correspond to artificial cerebral impressions not yet made fully permanent; for they are easily effaced when the animal, deprived of human society, relapses into savagery. This development of the dog in so remarkable a manner is the result of his having been the first mammal domesticated; hence man has been more occupied with him, has demanded a greater variety of services from him, and has taken more lively care of his moral and mental education. Other animals, on the other hand, domesticated simply for the butcher's handling, like the ox, the sheep, and the pig, have degenerated rather than gained by the association with man. They have lost the qualities they acquired during their ages of liberty without replacing them by others, and have fallen back toward the vegetative life.

Domestic animals sometimes acquire special educations of themselves, by the mere force of spontaneous imitation. Such are the dogs which, raised by cats, have learned to lick their paws and wash their face and ears, like their nurses. So several birds in a cage will imitate one another's cries, and even those of mammals; and parrots, as we all know, imitate the human voice. The brighter birds even do this spontaneously, without special training. This fact leads us to consider the faculty of language in animals, and the degree of development that may be given it by education.

It can hardly be pretended at this period that spoken language forms an impassable barrier between man and animals. There are many kinds of languages, and human speech does not differ essentially from the tactile and antennal language of ants. The mode of communication, indeed, varies according to the organization of the animal species; but it may always be found to originate in reflex actions, determined by a need, a desire, a feeling, an emotion, or an idea. Spoken language, which has, scientifically, been associated with the cry, the interjection, or the imitative onomatopœia, is at bottom nothing but a reflex action, a laryngeal gesture. A comparison of human and animal language is therefore legitimate, and is of interest in that it shows how the latter can be perfected by exercise and education.

It is evident that the particular form of language will be imposed by the organization of a species. Thus ants, organically aphonous, have devised for communication among themselves the antennal language, which places all the members of their city or nest in intimate communication. With birds, mammals, and men it has been more convenient to acquire a vocal language; but on occasion

men, too, have recourse to the tactile language. I once knew an elderly woman, deaf and blind, who could be conversed with in silence by touching one finger or the other, or this or that joint, to designate the different letters of the alphabet and even certain words and punctuation points. Travelers in the Orient, especially Chardin, have described a similar language as used by Persians and Arabs in making their bargains, so as to evade the impertinent curiosity of the crowd.

Singing birds have the advantage in language over all other animals except man. Among them, Syme has distinguished six classes of expressions: the call of the male in spring, the noisy sounds of mistrust, the warning uttered when a bird of prey is seen, the call of parents and the response of the young, the warbling or cooing of love, and cries of fear or of alarm for the nest. It is not necessary to suppose that this language of birds is inborn. It results, on the other hand, from acquisitions made during the life of the species which are not completely transmitted by heredity. Young birds have to go through a process of teaching to sing well. Their first efforts may be compared with the prattle of children. Singing language is the property only of particular species of birds. The crow does not sing like the nightingale, although it has a similar larynx. Young birds learn to sing by spontaneous imitation and practice, and of course take the song of their parents; but in aviaries they often copy the songs of other species, just as our children learn foreign languages by hearing them spoken. It therefore seems clear that the artistic talent of singing birds has been slowly acquired. The dog did not learn to bark till he fell into the society of man. He does not, indeed, imitate human language; but, desiring to express novel feelings, he has created a language of his own in order to communicate with his master: barking, four or five tones rich. The domestication of the dog is further so ancient a thing that it is pertinent to ask whether man himself had at that time any other language at his disposal than modulated cries. But although they do not speak as we do, dogs very well understand some words and phrases, and by training this intelligent comprehension of language can be greatly enriched. Their mental condition may be compared in this respect to that of our children between the ages of ten and twelve months, who understand a considerable number of words, but are not yet able to articulate them. So, likewise, an adult man going into a foreign country learns to understand the words of the new language before he begins to speak them.

Our dogs understand, too, the languages of animals of different species with which they are associated. The dogs Houzeau kept in Texas to guard his poultry yards responded to the cries of the fowl

indicating that they were in danger, but not to the others. So wild dogs and howling dogs learn to bark after they become accustomed to hear their tamed companions bark. In view of the facility with which parrots learn to articulate words, it may be assuming too much to say, dogmatically, that animals can not be taught to speak. Instances are not wanting in which parrots have seemed able to speak intelligently. A very striking case of the kind is that of the parrot and the Duke of Nassau, cited by Locke in his Essay on the Human Understanding. Darwin mentioned a parrot that always said "Good morning" and "Good evening" correctly.

All these facts I have mentioned seem to me to demonstrate that the education of animals rests on the same basis as that of man; that in numerous species parents give their young a practical education, but of short duration; that an artificial education imposed by man is competent to divert and even metamorphose what are called the instinctive tendencies of animals, and give them new ones; and that repeated drilling of young animals, assisted on occasion by chastisement and recompense, is usually sufficient to obtain this result. It would be easy to show that human education does not proceed very differently, and that among inferior races it does not diverge greatly from that which many animals give their young.—*Translated for the Popular Science Monthly from the Revue de l'École d'Anthropologie.*

THE PRIMARY SOCIAL SETTLEMENT.

BY KATE KINGSLEY IDE.

WITH the close of this century the "woman question," as such, will have practically settled itself in the United States, to the immense relief of a great number of people. In its wake have followed "child study," of special interest to kindergartners and mothers' clubs; paidology, the new science of the child, claiming the attention of college men and demanding a college chair; and oikology, a new name for the science of housekeeping or household economics. Oikology, from its Greek derivation, includes also family life or homekeeping, which has but recently appeared on the horizon of science and literature as worthy of particular study. It will not be in dim perspective much longer. The question of the family, of transcendent importance, is sure to come nearer and nearer, to grow larger and larger, and to demand the attention not only of economists and sociologists but of thoughtful men and women everywhere. The national "Congress of Mothers" will soon

be superseded by that of fathers and mothers, and, finally, by that of the whole family. It is in the air that the family, the home end of the social problem—the primary social settlement, if you please—is to have a renaissance, a new birth. Twenty-five years ago Charles Dudley Warner feared that with the going out of the hearthstone and the hearth fire, with its big aromatic back log of hickory, the family would go. It has not gone, but it has suffered neglect and decay to the extent that, like a smoldering fire, it needs new fuel and a big bellows to blow the embers into healthy life and warmth, to create a family atmosphere and make it contagious.

Because the disintegration of the family is threatened, because its decline is asserted, because family life in America has become a target for some foreigners to shoot unpleasant remarks at, there is no reason to take a pessimistic view, but rather to believe that family extremes have met, that the family pendulum has swung either way as far as it can, and will, according to the law of rhythm and reason, swing back to middle ground, to reorganization, resetting, reintegration.

It is incongruous in a country widely reputed for its homes that the house should be better than its inmates, the container of more account than the thing contained. To this end public opinion, that mighty factor in all forces, including social, needs to be aroused. The general thinking and reading public is not yet awake to the family idea. I know of no practical and pertinent subject that there is such a dearth of literature on as on family life, of more importance in the history of nations and in the history of the world than any other one thing. I know of but one entire book* on the subject, and that was published ten years ago, and discusses the family historically more than ethically and sociologically. There are, however, chapters in several books that treat of the family in a scientific way. Our government, in the interest of science, sends out expeditionists to discover the north pole. For the sake of humanity as well as sociology, which “is nothing but systematic knowledge of human beings, who have always been commonplace and at the same time mysterious,” it has become necessary for expert observers to discover or rediscover the family, and for the family to discover itself as microscopic society, and especially as the prototype of the nation. The old-time classification of social institutions into family, church, and state, with the family as the unit of society, and society the aggregation of families, has been somewhat changed. The individual is now the unit of society, and in some quarters of Germany and this country there is added a fourth

* *The Family*. By Dr. Thwing.

class, "civil society, thereby designating economic life." They have some difficulty in disposing of the family, but are inclined to set it aside as an institution by itself, closely related to all the others, calling it the "primary social form," in which the cell, the individual unit, is found. I think it is Dr. Mulford who says: "The family is the natural and the normal condition of human existence. It is not the unit of society that is the ultimate and integral element, but it is the unitary form of society." Yet, as the individual is rarely separate from and outside of some kind of a family, and as social life is more generally concentrated in the family than in any other institution, I can not see that it makes the family more or less primary—that is, *chief in importance*—either by calling it the social form of the unit of society, or the unit of society itself. The old system of classification will probably continue to be used in philosophical if not scientific discussion of social institutions.

Conditions past as well as present must be understood before one would dare prescribe remedies for the present threatened disintegration of the family. A surgeon, before attempting a certain operation, has his assistant spend hours with the patient, writing up the history of the case, as to heredity, environment, causes and effects, not only for his own benefit and the patient's benefit, but for the benefit of surgery in general. A history or prehistory of the family case is altogether too long for a magazine article, but we may get kaleidoscopic if unsatisfactory views of the family in its evolution by means of such authorities as Moses, Homer, Christ, Paul, Plutarch, Dr. Hearn, Sir Henry Maine, Letourneau, Starcke, Professors Maurice, Drummond, and Small.

One should never judge of the ancient domestic institution by any modern standard, as is too commonly done. Neither is it well to use the modern name, family, but rather household, for the Semitic and Aryan domestic establishments, so extensive and complicated in their various ramifications, laws, and customs. From the Semitic (more properly Shemitic) household the modern family has evolved, although Herbert Spencer is at variance with the theory that the infancy of society is found in the patriarchal group. His evolution goes back to an aggregation of males and females without settled family arrangements. Be that as it may, it is a fact that all societies were originally organized on the "patriarchal theory," based on the scriptural history of the Hebrews. The Hebraic household was really a corporation. At the head of this corporation was the patriarchal father, with absolute power over wives, children, servants, household property, and in a representative way over the flocks and herds of his sons. Such households were those of Abraham, Jacob, and Laban.

Modern ideas of the family are based, of course, on monogamous marriages, which many people seem to think did not exist either in sentiment or reality until the Christian era. This is a big mistake. In the original divine ordinance of marriage, "And the Lord God said, It is not good that the man should be alone: I will make him an help meet for him" (Genesis, ii, 18), and "Therefore shall a man leave his father and his mother and shall cleave unto his wife; and they shall be one flesh" (Genesis, ii, 24), monogamy is implied, and also in what Christ said in Matthew, xix, 5, 6, and Mark, x, 7, 8. Monogamic, polygynous, polyandric have always been numerators over the common denominator, marriage, yet for reasons pertaining to personal comfort the monogamic family has been the commonest, and existed in higher nations long before the Christian era. But Christianity gave a new motive for its existence. It made the underlying spirit of family life more important than the laws and customs pertaining thereto.

Among the Semites, confusion, trouble, and hatred ever resulted from the practice of polygamy, which, though not prohibited by Moses, was restrained and discouraged. The first-born, whether of the beloved or hated wife, was to have his right, and citizenship was denied to eunuchs.

But even in the domestic darkness of polygynous households, parental love often shone like a bright light, though sometimes it was the light of favoritism. "And Isaac loved Esau." "Now Israel loved Joseph." Hagar, lifting up her voice and weeping over against the shrubbery where she had placed Ishmael, so that she could not see him die, is a most pathetic picture of a mother's love. The love of home, too, was strong even in the wandering days of the patriarchs, who delighted to obey the frequent command, "Return unto the land of thy fathers and to thy kindred." In other family affections these old Hebrews are still an example for us. Ruth's love for and companionship with her mother-in-law, Naomi, is a touching part of the beautiful biblical idyl. Old age was revered. The grandfather's blessing on the sons' sons was of greatest account. His words were desired and cherished. Even Rameses sought and obtained the blessing of the old man Jacob, who was given by the king not simply a living place in some corner of Egypt, but in "the best of the land." Brotherly love was often conspicuous in contrast to brotherly hate. Joseph, the ruler, in the second chariot of Egypt, not only looked after his father by express command of the king, but his brethren and all his father's household, "according to their little ones."

The influence of this primitive social institution, the ancient family or household, has been felt in law also. Maine says: "It is this patriarchal aggregate, the modern family thus cut down on one side

and extended on the other, which meets us on the threshold of primitive jurisprudence. Older probably than the state, the tribe, and the house, it left traces of itself on private law long after the house (another name for gens) and the tribe had been forgotten, and long after consanguinity had ceased to be associated with the composition of states." He also says: "It will be found to have stamped itself on all the great departments of jurisprudence, and may be detected as the true source of many of their most important and most durable characteristics." This is but another proof that the best things in law and love are always up to date.

Polyandric households prevailed to some extent where women were outnumbered by men, and polyandry is practiced now in some parts of Europe, India, and among certain tribes in the Pacific Islands and America. Among the usually polygynous Indian tribes, the Iroquois was a single monogamic exception.

Polygynists and polyandrists can never have known love in its quintessence. Love, unlike coffee, can not be diluted with safety for family use. Only the pure, strong extract is the basis of a true union between one man and one woman. And such a marriage is the only fit foundation for family life. True, there have been weddings—that is, ceremonies, festivities, and trousseaux—without love, but if the family had depended on the mere correlation of the sexes it would have died an early death as an institution. Professor Drummond explains how conjugal love came into existence in this way. Speaking of the loveless marriages of the early races and how love came, he says: "If neither the husband nor the wife bestowed this gift upon the world, who did? It was a little child. Till this appeared, man's affection was non-existent, woman's was frozen. But one day from its mother's very heart, from a shrine which her husband never visited nor knew was there, which she herself dared scarce acknowledge, a child drew forth the first fresh bud of love which was not passion, a love which was not selfish, a love which was an incense from its Maker, and whose fragrance from that hour went forth to sanctify the world."

However, it was never intended that parenthood should precede conjugal love, but rather that it should strengthen it. Mrs. Browning's interpretation of conjugal love in the first human family before the first baby came seems reasonable and right. In the Drama of Exile, Adam thanks God

"That rather, thou hast cast me out with her
Than left me lorn of her in paradise,
With angel looks and angel songs around
To show the absence of her eyes and voice,
And make society full desertness."

And Eve responds:

“I am renewed ;
My eyes grow with the light which is in thine ;
Because I comprehend
This human love, I shall not be afraid
Of any human death.”

Monogamous love marriages have not only improved the family physically, psychically, and ethically, but society as well. The decline and fall of Rome can be traced to her corrupt domestic life. The moral progress of the nation ceased when sacred family life ceased. The names Pompey, Cæsar, Antony, Cicero, not only suggest intellect, power, splendor, conquest, and oratory, but divorced wives, paramours, unfathered and unmothered children, and marble palaces that hadn't the faintest semblance of homelikeness. The high civilization of Rome could not afford to throw off the family, which, then and now, either as a blessing or curse, is the primary social group from which evolves all society. The advancement of learning has never yet been sufficient gain for the loss of domestic morality. But even in the so-called morally pure Roman households, family right swallowed up individual right as a larger fish swallows the smaller. The *paterfamilias* was a tyrannical lord, who crushed any signs of asserted individualism. Pride of ancestry and patrimony surpassed natural affection. Occasionally there was a Catonic exception, who believed that a good husband was more praiseworthy than a great senator. We know that the elder Cato left urgent business to help wash and dress a newborn son, that he taught the growing boy to read, to use correct language, to box, to swim, to fight in armor, and to endure hardships. He even wrote historical books with his own hands and had them printed in big characters, that the boy at home might read of the brave deeds of his countrymen and thus unconsciously imbibe patriotism. It is significant that the dignified Roman Portia boasted not only of being the wife of Brutus, but a Cato's daughter.

Homer looked upon domestic relations, in some sense, as divine relations. Odysseus constantly had consideration for home and wife. The sanctity of the marriage vow is noticed particularly in the *Iliad*, a poem that does homage to hearth and home. And when conjugal and parental relations in classical Greece were outraged, she too, like Rome, felt the result in all her social fabric. At the time when her children were looked upon chiefly as additions to the state and army, we get a glimpse of a certain family relation not wholly unlike that of to-day. Themistocles, when his son was making demands on him by means of his mother, said: “O woman, the Athenians govern the Greeks, I govern the Athenians, but you govern me, and

your son governs you; so let him use his power sparingly, since, simple as he is, he can do more than all the Greeks together."

The ancient household in Hellas and Italy was held together by authority, obedience, and domestic worship. The hearth was the altar—the Vesta—with its holy fire. The Aryan house father never died, but lived on in his male successor and in the family hearth worship to his memory. The Lares and Penates devotion was a crude religion, but veritable. The hearth was the family center, the house spirits were the guardians of the hearth. Everywhere primitive religion seemed to be domestic. It is related that the Russian peasant, in changing his house, raked the fire from the old stove into a jar and carried it to his new home, where its arrival was greeted with the remarkable salutation, "Welcome, grandfather!" If the fire for any reason could not be taken, a fire shovel or poker was substituted. In the brownie, hobgoblin, and Robin Goodfellow of the British Isles it is easy to trace the belief in ancient house spirits. In the Orkney Islands, hardly more than a century ago, there was in every family a brownie who was so helpful in corn-thrashing and house-cleaning, and withal so fond of milk, that "when the people churned, they sprinkled a little of the churning in every corner of the house for Brownie." I suppose this appeasing perquisite for spirit drudgery was but a forerunner of the modern servant's "tip," an abbreviated form of "to insure promptness."

As we come to the Christian era, the old family idea begins to wane. Christ emphasized the family, but also the relative importance of the individual in the family, and the immense importance of little children and childlikeness. From the fact that the founder of Christianity was born and lived in a family, there arose a new conception of fatherhood and motherhood. From the fact that John the Baptist was the cousin of Christ, and James, the author, his brother or near relation, and the Bethany family his close friends, the bond of brotherhood, blood relationship, and friendship has increased significance. That the Christ had a long family pedigree with royal blood in it is of interest; but it is more interesting to know that the carpenter's son, in a poor family (immediate) with meager surroundings, became a great man followed by crowds of the common people, in spite of a prevailing unbelief in his Messiahship. It is of supreme account to any family that this Jewish boy, growing tall and learned and in favor with God, was not disagreeable to men and was subject to his parents in all matters, except in the sphere of conscience, where even parents may not enter unbidden.

It is doubtful if Paul had wife or children, yet he seemed to know a great deal about other people's children and family life, at such great centers as Ephesus and Corinth. His lengthy commandatory

advice in this direction, and his calling attention to the moral inheritance of the child in the case of Timothy, show that he considered the family the primary social settlement.

Feudalism was, perhaps, a means of developing individualism in the family. Dr. Thwing says: "When not waging warfare, the lord in his castle on crest or side of hill was bound into an intimate and strong relation with wife and children. They were separated from society, and compelled to find satisfaction and contentment in each other. This tended to place members of the family on absolute equality." However, in humble homes, among families without rank or reputation, degradation was developed through the abusive power of the lord over the wives of his dependents.

A most beautiful type of family life is seen at the beginning of our own country in colonial days. It is a revelation to watch the observance of that home amenity—the just consideration of each other—in the Winthrop family, as it grew into nine children and several faithful domestics, who always went to church with the family, and were buried in the family lot. It is as fascinating as a realistic novel, in the best sense of realism, to see them go from an old world to a new, under trying circumstances, yet remaining loyal to each other in enforced absences and exasperating losses. The post-nuptial love letters of John and Margaret Winthrop are as fervid as the prenuptial. The eldest son in this family is like a younger brother to his father, sharing responsibility and labor with him, and always a noble stepson to his loving stepmother. The filial respect, the family government, the family economy, the family unity, the family simplicity, and withal the family hospitality, so sincere and generous as to include the soldier, the sailor, the farmer, John Eliot the missionary, the London lawyer, and the Oxford scholar, who are welcomed without fuss or fume to succotash, hominy, hasty pudding, pumpkin pie, and a feather bed, exhibit a type of family life that puts to shame a merely outward colonial home—a house—full of things, and empty of real lives.

After the picture of the "Governor's family," and the lapse of two hundred years, we may catch a glimpse of a famous social group whose influence has been felt throughout this whole century, in American literature, education, philosophy, and theology. Civil society, also, is largely indebted to that Litchfield family of Lyman Beecher, whose mandate—"Mind your mother! Quick! No crying! Look pleasant!"—was obeyed in military fashion. This household was pre-eminently cheerful, witty, literary, social, and free in its development. The growing young people were not uneasy to go somewhere every night, because the older and younger enjoyed and appreciated each other in delightful evenings at home, where con-

versation was educative, thrilling, and amusing, with true story and anecdote. The young Beechers had plenty of wholesome household and out-of-doors work during the day, so that to be with the family at night was as restful to them as evening basketball and feats on the trapeze in the gymnasium, away from the family, are to our young people. Their prayer meeting was "family prayers." Their literary club was a family affair. Their theater was a family affair with continual star additions in men and women from far and near, that gave and received large measures of profit and amusement, thus instituting a family reciprocity that has, finally, been copied by the family of nations.

The last turn of our kaleidoscope reveals a strangely contrastive picture that we have read about, if we have not seen. Let us hope that it is exceptional if true. The father in work-harness from January to January boards and lodges at the family residence, and pays all the family bills, when he is able to. If guests ever find him at home he seems to have "dropped in by accident," gives them a perfunctory handshake, says nothing, or something mechanically, and is at a loss how to behave generally. His son Jack, a little "unsteady," is conspicuous by his absence at his bachelor apartments. His wife, "jeweled like a Hindu idol," smiles, converses, and does the proper things—from chaperoning the young ladies to the opera to settling "quarrels below stairs." Sometimes the family—that is, the female portion of it—"passes years in Europe" for the health or deceptive veneering of daughters who may not know the names of half a dozen mineral springs in their own country, and who forget that the United States has a few cañons, a few mountains, a few universities, and a few art collections. Somehow, the management of this family has come to devolve on womankind. One writer makes the modern father "a hopeless victim, . . . forced into a style of living which exceeds his means and violates his tastes, forced to yield the guidance and discipline of his children to systems with which he has no sympathy, forced to these sacrifices by the relentless will of an elegant wife." Allowing that this last family picture is unusual and extreme, it is still plain to any keen observer that the pendulum has swung from excessive familism to a somewhat normal domestic life, and then outward to a riotous individualism that indicates family decline if not consumption. Among the most potential causes of this condition are:

1. Complexity of home architecture, furnishings, and personal wardrobe.
2. The apparent apathy, willingness, or submission of men, in yielding to women rights and privileges that belong to themselves.
3. The feverish desire for liberty at any cost.

4. Fewer marriages and more false marriages, with the ever-ready divorce escape.

5. The great and increasing opening in the economic world to female labor.

6. The unparalleled multiplication and popularity of clubs.

7. The willingness of outside institutions to assume functions of the family, and the readiness of the family to transfer them.

REMEDIES LIE IN CAUSES.—In the perplexing mizmaze of the modern residence, in the undue attention to the multiplex mysteries of the modern wardrobe, in the multiform engagements of the modern individual, the family is losing its identity. When some Ariadne puts into its hand the silver cord of *simplicity*, the family, if it holds on to the cord, will be helped back to its rightful place. Simplicity can not be adorned. It is a grace of itself, whether in a house, a face, or a gown. Simplicity will never entangle the family, so that one by one the individuals will want to extricate themselves and run away. If it is not desirable to return to white houses with right angles and green blinds, to the big kitchen with its big fireplace and crane—a kitchen where the family gathered for ciphering, and knitting, and appleparing, and reading aloud, and “fox and geese,” and blindman’s buff, without a thought of “the carpet”—it is desirable that we make some kind of a rallying center where the family will feel free, comfortable, and communicative. Even the center table is being banished in some homes, and the easy settee and high-backed lounge have been superseded by a luxurious-looking couch, piled high with pillows, some of them pretty to look at, but often too dainty for use. Things merely “to look at” should be confined largely to walls, mantels, pedestals, and portfolios.

A partial reintegration of the family will take place when the house father stands for authority, judgment, and righteousness as much as the house mother for patience, tact, and love. In the animal world, with the exception of the birds, the fathers are nearly all family backsliders. In the human family, business and business worries have been excuses long enough for a man to leave family management entirely to his wife. Adam and Eve *together* were to have dominion over everything. No man has a choice of the family he is born into, but he is responsible for his own family, which he should never have established unless he chose to be the head of it, or one of its heads, and wisely co-operative in its development. No true father need to be “forced” into false family living. When he permits himself to be so forced he is a backslider.

Individual liberty along most lines means advance and advantage; but such liberty without becoming restraint, especially among mere boys and girls in the family, results in rebellion at home and

anarchy abroad. Individualism running riot is like a frenzied runaway horse that finally clears himself of every attachment. Before the individual thus runs away with himself, it might be a good thing in the United States, where there is such a general movement of liberation, to return to the family as the social unit. That the lack of individualism was the bane of the ancient family, and the excess of it is the bane of the modern family, shows that in both family and state "real liberty is neither found in despotism nor in the extremes of democracy, but in moderate governments."

There are those who think fewer marriages are due, among other things, to the fact that so many women are embracing the "higher education." It is true, such women are no longer satisfied with a husband who is merely a "good provider" of material things. But this is not ominous. Highly educated women crave companionship, but such as includes the intellectual and moral. Family life needs the leaven of a good intellectual heredity as well as physical. No amount of education will ever destroy maternal or wifely love in a true woman, illustrated in the case of George Eliot and our Margaret Fuller, who was never happy until she became the "*mia cara*" of Ossoli, and the mother of the blue-eyed Angelino. The man who, like Helmar in Ibsen's *Doll's House*, wants in a wife only a lark to sing for him, a doll in soft and silken gown to dress up his home with, will still frown on the higher education for women.

When one sees a bridegroom chewing gum during the entire marriage ceremony, and discovers six months later that the bride (the third wife) has secured a divorce, one concludes that quality of marriage is more essential than quantity. I heard a gentleman say, not long ago, that "one reason why more young men do not marry is because fathers do not set us an example in family happiness, nor look upon family happiness as a success to be won." False marriages, like those of Dorothea and Casaubon, Gwendolyn and Grandcourt, Andrea del Sarto and Lucrezia, occur because the seriousness of the marriage relation is not understood.

When parents, by example and precept, teach their children the sacredness of marriage, when clergymen are not so fast to tie the knot, and lawyers to untie it, the foundation for the family will be stronger.

Arthur Fairbanks, in his recent book, reasons that the economic problem concerns the family even to a greater extent than the divorce problem. He thinks when a woman is obliged to go into the factory or shop to eke out a husband's earnings, which have become smaller and smaller because men have come into competition with women willing to receive lower wages for the same work, the effect is deleterious upon the family. It is still more alarming when women,

simply because they dislike housekeeping and the "bother" of little children, put an inefficient or efficient substitute in the position of family care-taker, while they themselves accept a clerkship in the husband's or stranger's down-town office, under the subterfuge of earning more than enough to pay for the extra service at home. Assuming maternity and shirking motherhood is even more dangerous and condemnatory than assuming paternity and shirking fatherhood. I understand from our Commissioner of Labor, Mr. Carroll D. Wright, that 88.7 per cent of employed women are single. If this is not true, and the majority or even a large minority of women wage-earners are married, then it is a serious matter that may be regulated in some degree by sociologists and capitalists.

The writer is a member of two clubs that are stimulating and helpful to the primary social settlement—the family—and believes that a moderate use of the club, like that of any good thing, is desirable. But when the club is ubiquitous and disproportionately valued, so that men, women, and adult children "recognize themselves more by their badges," and care more for ties of ribbon than ties of blood, then the club is inimical to home life. The remedy for this is in making the family a fraternity—an enlarged fellowship of people and ideas, a comradeship, that shapes itself into forms of mutual helpfulness. When heads of families, who now entertain their gentlemen friends in elaborate, expensive ways of eating and drinking at their clubhouse, are free and willing to bring them to the family house, where eating and drinking shall be the subordinate part of a home welcome; when it is the custom of women to open the doors of their homes and hearts in retail hospitality, instead of disposing of social indebtedness in the lump, as it were, at their clubhouse; when the ornaments of a house are "the friends who frequent it" and the family who live in it, and when courtesy between the members of the family is as pronounced as that between club members; when family amusements are pleasant and recreative, the home will be as popular as the club. To avoid disintegration and disloyalty, the family must satisfy the reasonable desires of its individual members.

That very important family function of communicating psychological impulses is too often disused, abused, or transferred. When this function is in normal exercise,* the family conversation at table is not the same category of questions and answers as to individual tasks, or the familiar rehearsal of the grocer's blunders, the servant's inefficiency, or the children's mishaps.

* See *An Introduction to the Study of Society*. By Small and Vincent, p. 246.

The family is the original social group, the oldest school, and should not transfer its legitimate functions to the kindergarten, graded or high school. The kindergarten is unimpeachable in aims, if not methods. Public schools, in general, are something to be proud of. But the kindergarten is limited in its mission without family co-operation, and "the public school accomplishes but little, except when it supplements the intellectual life of the home." Perhaps the latest assumption of family functions in the school line is seen in the establishment of parental schools for incorrigibles, usually under the care of school boards. Not only are incorrigibles provided for by public institutions, but the sick, the aged, the infants, the imbeciles, and a legionary body of unfortunates. Benevolent and reformatory institutions must needs be, in moderation, especially for such classes as the blind, the deaf-mute, the insane, the orphan, and the homeless. But, as propagation is the exclusive function of the family, is not the family bound to do its best and its utmost for its own progeny? Are not families becoming too willing to roll off family burdens on to the state?

Even the religious training of children is willingly turned over to the church and Sunday school by families capable and responsible not only for laying foundations for the Sunday school to build upon, but for co-operating with the Sunday-school teaching. The Jewish church began in a family, and the Gentile church began in a family. Does the family pew in the meeting house show that the church is still in the family, or does it indicate family disintegration? If it does, there will be reintegration when fathers and mothers no longer look lonesome in the "family pew" because their children are scattered around in other pews, visiting with other people's children, or in other assemblies, or off on the road bicycling, and when children no longer look lonesome in the family pew because parents are "taking it easy" at home.

The aim of social settlements, like the Hull House, Andover House, Hiram House in this country, Oxford House, Mansfield House, and the teetotums in London, is to supplement family life, or, more correctly, to substitute something for nothing, or something good for something bad in the numerous and prolific families that barely exist in one room, two rooms, or three rooms in the rookeries of all great cities. This fact, together with the facts we have been considering, proves the family to be the social group first in importance, as well as first in order of being. And so we conclude that there is not only danger to society in the ill performance of family functions in "Mulberry Bend," New York; Drury Lane, Bethnal Green, and Spitalfields, London; in the two- and three-hundred-

years-old closes, wyndes, and laundes of Edinburgh and Glasgow; but also in homes on light and clean streets and famous avenues.

Obligations of society toward the poorest poor can not be lessened, but they can be increased toward the rich and the richest. "There is no duty of one class toward another which is not essentially the duty of each human being to all his fellows. There is no genuine charity toward the poor which is not, in principle, the duty of the rich toward the rich."

The art of living together domestically is a fine art, that seeks expression through beautiful family life which is not extinct, but comparatively rare. Along with renaissance, in architecture, painting, and sculpture, why may there not be a family renaissance, so that men, women, and children shall feel that the real life of the world is not in the counting house, clubhouse, schoolhouse, meeting house, courthouse, or statehouse, but in the family house—the dwelling house?

SKETCH OF CHARLES D. WALCOTT.

A "NEW YORK GEOLOGIST," whose name is not given, is quoted as having attributed Mr. Walcott's success largely to his having persistently followed one track. Acquiring a taste for geology when very young, it eventually became dominant, and more and more manifest to the world about him, till he secured a position in the United States Geological Survey. There he has risen, chiefly by the force of his ability and energy, to his present position of director of the survey.

His grandfather, Benjamin S. Walcott, moved from Rhode Island in 1822, and became one of the leading manufacturers of central New York; he had broad interests in educational matters, was the founder of a professorship at Hamilton College, and was well known as a philanthropist. His son, Charles Doolittle Walcott, was a man of unusual energy, was well established in business, and held an influential and leading place in the community. Dying at the early age of thirty-four, he left a wife and four children, the youngest, two years old, being the subject of this sketch.

CHARLES DOOLITTLE WALCOTT was born at New York Mills, N. Y., March 31, 1850. His scholastic education was in the public schools of Utica, which he entered in 1858, and in the Utica Academy, which he left in 1868. He then entered a hardware store as a clerk and, continuing in such occupation two years, acquired a practical business training, which has proved of great value to him.

His scientific tastes were developed at the age of thirteen, when

he became interested in collecting fossils and minerals. A few months afterward he met Colonel E. Jewett, geologist, paleontologist, and conchologist, from whom he borrowed books and received many suggestions, and through whose influence he became a student with method. Geological collecting and reading were continued during the remainder of his school life, and other scientific studies were also taken up. For two winters he devoted much time to optics and astronomy, and incidentally made large collections of insects and birds' eggs.

During the summer of 1867 a drift boulder, accidentally broken by his buggy wheel, revealed to him fossil forms so different from those of the neighboring Trenton faunas that his interest was greatly excited, and in seeking to learn their origin and relations he was led to examine the literature of the pre-Silurian fossiliferous formations. He soon discovered that relatively little was known of them, and also that there was much confusion in the classification. It became his ambition to make a thorough investigation of all the pre-Trenton sedimentary formations and faunas in their geological relations, and in their relations to the development of life and the evolution of the North American continent, and this was later taken up as his life work in geology. His range of observation was also enlarged by excursions in Herkimer and Oneida Counties, where he met examples of Archæan and Glacial as well as Palæozoic formations.

In 1871 business took him to Indianapolis, where his scientific tendencies were further stimulated by Prof. E. T. Cox, who was then making a geological survey of the Indiana coal fields. The time now arrived when it seemed necessary to choose between a business life and a life of research. A partnership was offered him on favorable terms, and if he accepted its responsibilities little time would remain for study and investigation. If, on the other hand, he devoted his life to science, it was important that he secure more time for its prosecution than was consistent with his present business engagements. Deciding in favor of scientific work, he left Indiana and returned to the collection and study of Trenton fossils in New York.

While a schoolboy he had spent summer vacations on a farm near Trenton Falls, a region of great geological interest and peculiarly attractive as a collecting ground. On determining to follow a scientific life he returned to Trenton Falls and established himself on the farm of William P. Rust, where he arranged to do a certain amount of farm work, reserving the remainder of his time for his chosen studies. Here he remained five years, gathering a rich collection of local fossils, beginning their systematic study, and enlarging his horizon by extensive excursions on foot during the spring and fall.

His paleontological collections included a unique series of Trenton limestone fossils, which was sold in 1873 to Prof. Louis Agassiz, and his intercourse with Professor Agassiz at that time was most helpful and stimulating. An arrangement was made for Mr. Walcott to go to Cambridge and pursue a course of study under the advice and direction of the great naturalist, but this was frustrated by the death of Agassiz.

In November, 1876, he received his first official appointment, becoming assistant to Prof. James Hall, State Geologist of New York. While holding that position researches were made in New York, Ohio, Indiana, and Canada. In July, 1879, Mr. Walcott was appointed field assistant in the United States Geological Survey, then under the direction of Clarence King, and was assigned to the study of the great geological section extending from the high plateaus of southern Utah to the bottom of the Grand Cañon of the Colorado. In 1882 he collaborated with Mr. Hague in the survey of the Eureka mining district of Nevada. The Palæozoic paleontology of the survey was now assigned to him, and, though this entailed considerable routine work in the identification of fossils brought from many fields by the various geologists, he was enabled to pursue with vigor his cherished plans for the investigation of the older faunas. He examined the Cambrian formations of the Appalachian belt all the way from Alabama to Quebec, and carried his researches on a more easterly line through New England and New Brunswick to Newfoundland. He also began a series of western studies which eventually included the most important known bodies of Cambrian rocks in Texas, Arizona, California, Idaho, Nevada, Montana, Wyoming, and South Dakota. In 1888 he was advanced to be paleontologist in charge of invertebrate paleontology in the Geological Survey; in 1891, to be chief paleontologist; and in 1893, to be geologist in charge of geology and paleontology, in which capacity he had charge of the general direction of that branch of the work of the survey. In July, 1894, Major J. W. Powell, after fourteen years' service as director of the survey, retired from that office, and Mr. Walcott was selected by President Cleveland to succeed him.

Mr. Walcott's service to science falls under two heads—research and administration. The scientific study which results in positive additions to the world's knowledge has a somewhat definite course, beginning with the observation of phenomena, proceeding with their arrangement in classes, and concluding with hypothesis and theory as to their natural sequence or genesis. Classification and hypothesis afford new points of view which lead to additional observations, so that the various steps of the process are to a certain extent alternated; but the most successful researches, those whose results

are of a permanent character, begin with a broad foundation of observation. The work that begins with theory and afterward seeks for verification through observation may be brilliant and attractive, but its results are rarely of lasting value. Mr. Walcott's scientific work has followed the normal and conservative course, beginning with the prolonged collection of specimens and other facts, following with generalization, chiefly in the field of the correlation of formations, and leaving largely to the future conclusions as to sequence and genesis.

His paleontological studies have been of two classes: biological, viewing fossil organisms as members of the animal kingdom, and stratigraphical, viewing associated fossils or faunas as the representatives of contemporaneous life and the labels of synchronous formations. His biological labors include the description of a considerable number of new families, genera, and species of Palæozoic invertebrates, and an elaborate study of the structure and organization of trilobites, which has served to give them, for the first time, a definite and unquestioned position in the systematic scheme of animal forms.

The trilobites were dominant forms in early Palæozoic time, and continued, with diminishing numbers and importance, until the Carboniferous period. Exhibiting a considerable range of differentiation, they have been of great service for the classification of terranes, and the nomenclature of the Cambrian horizons has been based upon them. Nevertheless, their systematic affinities were long in doubt, because they were known only through imperfect specimens, exhibiting the dorsal armor, but showing no trace of appendages for locomotion, respiration, etc. From time to time the discovery of legs and other members had been announced and subsequently disproved, and geologists had become so skeptical as to the possibility of their determination that when traces of a leg were actually discovered by E. Billings, in 1870, little credit was given to the announcement. Here was an important biological blank to be filled, and Mr. Walcott, at the suggestion of Louis Agassiz, undertook to fill it. The examination of thousands of trilobite specimens perfect as to the carapace revealed but a few traces of organs, and it was found that those traces all came from a certain layer of Trenton limestone only a few inches in thickness. That layer was carefully quarried over a considerable area, even though it became necessary to remove several feet of superjacent strata. Several thousand complete tests were obtained from it, and two hundred and seventy of these were found to contain some of the missing members in greater or less perfection. To such specimens elaborate study was given, chiefly by means of translucent thin sections, such as are employed by the petrographer. With their aid, and through prolonged labor and study, Mr. Walcott

was enabled to restore and delineate all the more important organs, and thus make a satisfactory determination of the biological rank and position of the *Trilobita*.

In stratigraphical paleontology Mr. Walcott has thoroughly combined field studies of the strata with laboratory work on fossils. His most important local work has been on the so-called Grand Cañon section of Utah and Arizona, which exhibits an unusually complete rock series from Archaean to Tertiary, in the Eureka mining district of Nevada, and in the Taconic region of New York, Vermont, and Massachusetts. His work on the Cambrian formations of North America covered a wide geographical range, as already mentioned, and led to the systematic grouping of the Cambrian rocks in three chronological divisions, each characterized by a distinctive fauna. In 1888 he visited Wales for the purpose of making a personal study of the type district of the Cambrian system—the district rendered classic by the original labors of Sedgwick and the subsequent researches of Hicks.

Mr. Walcott's work of scientific administration began in 1891, when he was given supervision of all the paleontological work of the Geological Survey, and has been progressively enlarged to the present time. When called to the directorship of the survey in 1894, he took charge of a body of scientific work already well organized, and continued a policy of administration which for several years he had been instrumental in shaping. He had no important changes to institute which had not been contemplated by his predecessor in office, and his ability to develop and strengthen the organization depended largely on the confidence he was able to inspire in those members of the legislative branch of the Government who determine the amount and general purpose of appropriations. Between 1879 and 1894, while the survey was under the direction of Mr. Clarence King and Major J. W. Powell, the amount assigned by Congress to its work had been gradually enlarged from \$106,000 to \$459,640, and the great body of geological work thus rendered possible had so stimulated State and individual activity as to give American geology a new and unprecedented status. Not only did the publications of the survey constitute a library in themselves, but the valuable material which became available for unofficial publication led to the institution of two journals devoted wholly to geology, and the organization of a geological society publishing annually a large volume of Transactions. It was therefore a matter of great importance, alike to the science of geology and to the great economic interests involved in its development, that the man chosen to succeed Major Powell should command the respect and confidence of the people and their representatives, so that the national work

which had proved so fruitful and stimulating might be continued and enlarged. The event has proved the wisdom of President Cleveland's selection, for each successive Congress has increased the appropriation and enlarged the function of the survey.

A comparison of the appropriations for the current fiscal year with those made for the fiscal year 1894, just preceding Mr. Walcott's accession to the directorship, shows enlargement in many directions. The various items providing for the geological work proper, and the work in paleontology, chemistry, statistics, etc., show an increase of \$22,000, besides an item of \$50,000 for hydrography, which was not separately recognized in the earlier bill, although the work had then been initiated.

The body of work to which the title of hydrography is applied consists in the determination of existing water supply, both in streams and underground, and in the discussion of the economic availability of this supply for agricultural, municipal, and other uses. The importance of such work to agriculture and sanitation, and the need of investigation under national auspices, have been recognized for some years, but there has been doubt as to the particular bureau to which the research should be intrusted, and the responsibility has been shared at various times by the Geological Survey and the Department of Agriculture. It is now lodged wholly with the Geological Survey.

From the year of its organization the Geological Survey has performed a large amount of topographical work, making maps on which are shown not only roads, towns, streams, etc., but the shape of the surface. For a much longer period the United States Land Office has been engaged in surveys for the purpose of dividing the public land into townships, sections, and minor cadastral divisions, as a basis for transfer to individual settlers. The two works have to a considerable extent covered the same areas, but the purposes and methods of work were so different that for a long time it did not seem practicable to unite them. Recently, however, an extensive experiment has been made in that direction. The bills appropriating money for the land surveys have been so phrased as to permit the Secretary of the Interior to have part of the work done by the Geological Survey, and the experience of three years, involving the expenditure through the survey of about \$400,000, has shown that by using the administrative methods of the Geological Survey the two works can be carried on conjointly with less cost than was formerly found necessary for the cadastral surveys by the Land Office alone. For the present fiscal year the sum of money thus assigned to Mr. Walcott's direction is \$241,500.

Long agitation with reference to the waste of timber on the pub-

lie domain, and the danger of a timber famine in the future, have led to the institution of a number of forest reservations, and in the last year of his administration President Cleveland established, by proclamation, thirteen additional reservations. Under existing laws a vast body of land included in these reservations could not be utilized for agriculture or town sites, and the exclusion of settlers from so great a domain led to vigorous protest. The situation involved considerable strain, and there was danger that the attempt to protect the forests would fail; but a compromise was finally arranged, under the terms of which the Geological Survey was instructed to map the reservations, marking upon them the areas actually forested, and also the areas available for agriculture. One hundred and fifty thousand dollars were appropriated for this work, and another important duty was thus imposed on the survey.

The survey is also charged this year with the running of the northern part of the boundary line between Idaho and Montana.

Thus in four years three new functions have been given to the Geological Survey, and the sum of money intrusted to Mr. Walcott's administrative care has been enlarged from \$484,640 to \$967,840, an increase of more than one hundred per cent.

The individual who demonstrates high administrative quality by success in any one field is sure to find opportunity for its exercise in other fields, and Mr. Walcott has been no exception.

The death of Dr. G. Brown Goode, in the fall of 1896, had made vacant the office of assistant secretary of the Smithsonian Institution and director of the United States National Museum. The position is one that requires a rare combination of qualities. For this reason, and on account of the intrusion of outside issues into the matter, the secretary of the institution found the selection of a person to fill it difficult. It was offered to Mr. Walcott, but he declined to leave the Geological Survey. He finally consented to take the place temporarily, with the understanding that his duties should be confined exclusively to the charge of the museum; and this proposition being accepted by the Board of Regents, he now holds the position of acting assistant secretary of the Smithsonian Institution in charge of the National Museum.

Mr. Walcott is one of the younger members of the National Academy of Sciences, to which he was elected in 1895. In the same year the Bigsbee medal of the Geological Society of London was given him in recognition of his distinguished work as paleontologist and stratigraphical geologist. This medal is awarded biennially "as a recognition of eminent services in any department of geology, irrespective of the receiver's country," and Mr. Walcott was the fourth American to receive it.

Editor's Table.

EDUCATION AS A FACTOR IN EVOLUTION.

AN ingenious but somewhat paradoxical writer of the present day has lately said that, "were we all agreed as to the training of our children, we need not await the slow evolution of the social millennium; it would be achievable in the very next generation." His argument is that "if a generation can be reared to reverence a stick or a stone, an inanimate idol, and this or that grotesque religious system, it can be reared also to love and reverence man." The postulate here, it will be observed, is a very extensive one—"were we all agreed as to the training of our children." The meaning evidently is, that if our intellectual methods and moral principles were in complete accord, and if both were of the most advanced order, we might look for the speedy coming of the millennium. Why not? We should be all but in it ourselves, and when it came our children would hardly know the difference.

It does not seem to us that there is much advantage in this way of stating the case. We are *not* all agreed as to the training of our children. We are agreed, broadly speaking, in some things; but, unfortunately, the things we are agreed upon do not make very directly for the millennium. In the matter of education there is no opinion so widely shared or so strongly held as that education ought to be mainly a preparation for commercial success. It was said long ago that wisdom was "the principal thing," and that therefore we should get wisdom. That opinion has been before the world for some thousands of years, but it

has never yet dominated the mind of any society; and to-day, as much perhaps as ever, the feeling of the multitude is that money is the principal thing, and that therefore every effort should be bent on getting money. Apart from the teaching of school there is the teaching of daily life. Here again the most widely entertained ideals are not the best. The methods, for example, of the politician may almost be said to be imposed on him by the people. If the path to political success lay through a careful study of public questions with a view to the general good, our politics would be completely transformed and a new race of men would appear upon the scene. But the idea of the general good as a paramount object is one which, in the present state of our civilization, can not be brought home to many minds; and the fact that it is repudiated by the multitude renders it difficult for those who acknowledge and accept it to act on it in a consistent manner.

The writer we have quoted, Mr. Archdall Reid,* thinks that, because a generation can be educated to worship a stick or a stone, one might just as easily be educated to "love and reverence man." Well, as we have already suggested, if the preceding generation loved and revered man, its successor would probably do so also, and possibly in a slightly increased degree. But that is not to the purpose; the question is, whether the present generation, being what it is, could as easily train the next into all the virtues required for the millennium as a given tribe of savages might train its children to believe in

* See his article, *Characters, Congenital and Acquired*, in *Science*, December 24, 1897.

and perpetuate its own superstitions. To ask such a question is to answer it. Fetichism is a phenomenon which has made its appearance in every quarter of the world, and which belongs specifically to a certain stage of the human mind. It has its roots very deep in human nature, and we may be allowed to doubt whether those roots are entirely dead in any human being to-day. Certainly we see stray shoots springing up from them in the very heart of civilization. The most prosaic of us will conceive singular attachments for various inanimate things of no special intrinsic value. We say we prize them for their associations; but that is only another way of saying that *something* has attached itself to those objects which, *for us*, changes their character and gives them a certain human or, as we might say, spiritual interest. One of the sanest of English poets, Wordsworth, has given expression in more than one passage of his works to this sentiment. As to any intellectual difficulty involved in attaching sanctity to a stock or a stone, it would be little felt by a savage; but, so far as felt, would probably be an aid to the maintenance of the cult. Over a century and a half ago it was remarked by the philosophical Montesquieu that, "by the nature of the human understanding, men like, in the matter of religion, whatever supposes an effort, just as, in the matter of morals, they like, speculatively, whatever bears a character of severity."

It is clear, therefore, that to hand on a fetichistic worship nothing is necessary beyond the ordinary, spontaneous action of the tribe; and it is equally clear, we imagine, that to bring on what is popularly spoken of as the millennium in the generation in which our children will be the chief actors would require nothing short of a miracle. We are not

millennial people ourselves, and no determination to which we could possibly come in regard to the education of our children could have the effect of throwing them forward in moral development more than one generation. A tree may in a favorable year make a little more growth than in an unfavorable one; and a river may, in a year of unusually heavy rains, carry down more alluvium to an estuary than is carried down in an ordinary year. Thus we may conceive that a little more work for civilization may be done in one generation than in another; but any such variation will be confined within limits somewhat analogous to those which obtain in the purely physical region.

At the same time the problem of education is one deserving of the most earnest attention of all who are interested in social progress. Education is the debt of each generation to its successor, and, if we can not place those who come after us on a better footing than ourselves, we should at least see that we transmit an undiminished heritage. The aim should, of course, be—and among all but the most thoughtless, no doubt, is—to give those who come after us a better start than we had. The progress of science is doing wonders in the way of improving the surface of the earth; but the only progress which really makes for happiness is that connected with advancing ideals and better principles of action. Will the next generation enter upon active life with a higher conception, on the whole, of that in which the true value of life consists than we had at the outset of our career? It will be well if it is so; but it sometimes seems as if the most strongly marked characteristic of the next age would be a keener appetite for pleasure. If so, that is not progress. The late poet laureate of England

has told us in words which may be hackneyed by frequent quotation, but which can never lose their truth, that

"Self-reverence, self-knowledge, self-control—

These three alone lead life to sovereign power."

Modern state education can hardly recognize such a sentiment as this; but it must be recognized somewhere, or else we shall go backward, not forward. If every generation faithfully gives of its best to the generation that follows after, progress will be continuous and the equilibrium of society will be secure; but if at a given moment we begin to trust to governmental machinery and external forms and the general framework of laws to sustain the moral life of society the result will be disastrous. There is no life in these things. The poet moralist of ancient Rome had found this out when he exclaimed, "What are empty laws worth, unsupported by the moral sense of the people?" What is wanted is a deepened popular consciousness of certain commonplace moral principles—principles as old as the beginning of civilization, and yet which can not be held to, even in our own day, without an effort. To inculcate these is something very different from inculcating a system of fetich-worship; but it is the appointed task of the parents and teachers of to-day, and one which can not be neglected without grave responsibility.

SUBCONSCIOUS IMPRESSIONS.

AN interesting little book published by Dr. Louis Waldstein, under the title of *The Subconscious Self*, contains many hints that should be of use not only in the education of children, but in the general guidance of life. What the author principally shows is that the larger, and

perhaps the more important, part of each person's character is made up of habits, tendencies, preferences, aversions, moods, and principles of which for the most part the individual has little distinct consciousness, and that these at critical moments have often a decisive effect on his destinies. The recognized business of education is to cultivate the consciousness of the individual, and to furnish him with such a working capital of knowledge, ideas, and mental and moral habits as may enable him to do business, in the widest sense, in the world as it exists to-day. But what is thus by direct educative effort brought into a man's consciousness may not penetrate very deeply into his nature. It may, to a considerable extent, be a mere external equipment, and the real man may have been molded and stamped by circumstances and influences of which neither he nor his educators took much or any account.

The more we reflect on this the more we shall recognize both its truth and its importance. Parents sometimes wonder why the multiplied precepts which they bestow upon their children do not more powerfully influence their conduct. The fact is that the precepts in question go to form in the children's minds a fund of conventional opinions—those which they will use before the world—but the parents' own example, the thousand and one ways in which they practically manifest themselves, are subconsciously received by the children and go to form the underlying character from which most of their actions spring. Hence the common maxim that example is better than precept. Precept strikes the consciousness, but example constantly present sinks into the heart.

In every department of life we see only too frequently a very wide

separation between profession and practice. Profession comes from the region of the conscious, and practice largely from that of the subconscious. Of course, many actions, and particularly our most public ones, are dictated by the active consciousness; but those that make up the main tissue of our lives have their springs in a deeper region and furnish a better index to our true selves. It is of the highest importance, therefore, that the young should not only receive formal instruction in right principles, but that their habitual surroundings should be such as to promote the general health of the moral and intellectual nature. They should see as little as possible of angry passion, of selfish scheming, of duplicity in any form; and every effort should be made to lead them to appreciate and enjoy the finer and happier effects of Nature and all that is harmonious and elevating in the world of art and of human effort generally. It may be said that this would give them an incorrect idea of the world as it is; but it should be borne in mind that the object is to make the world other than it is—to make men and women more humane, more reasonable, more equitable, to endow them with more correct perceptions in all matters of taste, and fit them for a higher plane of social life. If we were to proceed upon the assumption that the world is incapable of amendment, and that the only thing is to make ourselves at home in it exactly as it is, there would be an end to all progress in education.

There are some good remarks in Dr. Waldstein's book about the danger of crowding too much into con-

sciousness and so impairing the subconscious receptivity of the whole nature. We have all heard of prodigies at school who have turned out very dull men in after life. As long as it was a question of absorbing the formal instruction imparted by masters, such individuals were far to the front; but afterward, when it came to be a question of individual resource, of energy, initiative, originality, they relapsed into quite a commonplace if not inferior position. It is very undesirable that anybody should be all consciousness. It is Shakespeare who says:

"If springing things be any jot diminished,
They wither in their prime, prove nothing
worth."

In our schools many a "springing thing" is thus "diminished" through the very forcing which seems at the time to produce so great an enlargement of mental faculty. The careful educator should be constantly asking himself the question, Is the mind before me getting into contact with *things*? and his chief effort should be to establish and promote this contact, so that the mind may draw instruction from its surroundings as a plant derives nourishment from the soil. There is nothing absolutely new in Dr. Waldstein's views, because ages ago men recognized the comparative futility of brilliant faculties unsupported by solid qualities of mind and character; but he has brought forward what he has to say at a very good moment, when, almost more than ever, we need the quiet teachings of Nature to curb our mental restlessness and enable us to "see things steadily and see them whole."

Scientific Literature.

SPECIAL BOOKS.

IN its multiplicity of anecdotes this study of sleep* resembles the early works of Ribot, and the author chats about each in an equally charming and irresponsible fashion. She is not chary, however, of generalizations, and a very limited number of examples suffices for wide inductions. In the regions of physiology and hygiene she gives a careful account of the phenomena of sleep, supplementing these with valuable suggestions of her own. It is only when she enters upon the pathology and psychology of her subject that she betrays herself as one of that school, mostly French and Italian, which may be called the romancers of science.

She laments that we understand so little about sleep, which absorbs one third of our lives. The extensive bibliography added to each chapter would seem to disprove a want of scientific attention. The circulation in the brain during sleep has been observed in animals by substituting a watch glass for a portion of the bone of the skull. Experiments have shown also that a withdrawal of blood from the brain precedes sleep, and all conditions tending to this result produce sleep. Heat or excessive cold, which draws the blood to the skin, is followed by drowsiness, and this is likewise the consequence of digestion which summons the blood to the large abdominal vessels. Debility and great loss of blood also cause cerebral anæmia and somnolence.

If it be inquired what is asleep within us, we find that it is only a part of the brain. It is possible for all the organs of the body to be active during sleep excepting partially the nervous system. The voluntary muscles are awake, also the sensory nerves and the cerebral centers controlling each. Only because the different nervous channels are sensitive is it possible to arouse a sleeping person. The author considers that the fact of being able to awake at a given time proves that the attention and will preserve their activity. After investigating the many hypotheses in regard to the causation of sleep, the conclusion is reached that sleep is the resting time of consciousness.

The pathological modifications of sleep embrace weakened and excessive activity. Complete insomnia is found only among the insane or extremely anæmic. Intermitent sleep is injurious, since there is not time in the fugitive rest obtained for adequate nutrition of the tissues. Partial insomnia is met with in persons who are liable to a flow of blood to the brain and those with unbalanced and irritable nervous systems. It is also the result of mental overstrain or extreme physical fatigue. On the other hand, excessive sleep has its attendant evils—the gradual weakening of consciousness and the mental faculties, and the production of serious physical disorders. Among rarer forms of pathological sleep the author discusses narcolepsy, latak, hypnosis, and somnambulism.

The hygiene of the subject brings up interesting questions. How much time should be given to sleep? What should be the light, temperature, and ventilation of the bedroom? Should habit control us? It is contended

* *Sleep: Its Physiology, Pathology, Hygiene, and Psychology.* By Marie de Manacéine. New York: Imported by Charles Scribner's Sons. Pp. 341. Price, \$1.25.

that too great uniformity proves injurious. Much attention is bestowed upon the hypnagogic condition or state of half-awakening; connection is found between this and some states of mental aberration, and it always denotes a weakened consciousness.

The point of view taken in examining the psychic life of sleep is that "the subjective method is of the first importance." Another divergence from scientific habit of thought is that "in attempting to explain facts by chemical affinity we still have to explain chemical affinity itself." Observations made by the author during five years on thirty-seven persons convince her that dreams increase with the variety and activity of intellectual life. The studies of an Italian investigator show that idiots rarely dream, criminals dream seldom and but little, the greatest criminals least of all. Whence she concludes that it is only under morbid conditions and among the uneducated that it is common to find an absence of dreams. Not only are the dreamless thus condemned to a low intellectual plane, but "old age comes on more swiftly in those who dream little."

Prof. J. Mark Baldwin's *Social and Ethical Interpretations in Mental Development** is a continuation of the studies in genetic psychology begun in the *Mental Development of the Child and the Race*. It is, however, independent of that work except in so far as the natural connection requires somewhat frequent reference to it. In view of the lack in English of a book on social psychology which can be used in the universities in connection with courses in psychology, ethics, and social science, the author has also endeavored to make his essay available for that purpose. This has led to such expansion of the fundamental ideas of the treatise as seemed necessary to a fairly complete working out of the social element in connection with each of the great psychological functions. The first part is, therefore, as far as its topics are concerned, a more or less complete study of social and ethical philosophy. The special object of the essay is to inquire to what extent the principles of the development of the individual mind apply also to the evolution of society. The study, therefore, falls into two main inquiries: What are the principles which the individual shows in his mental life—principles of organization, growth, and conduct; and what additional principles, if any, does society exhibit in its forms of organization, progress, and activity? Of the three methods by which the author conceives the subject may be investigated, he chooses what he calls the *genetic*, or that "which inquires into the psychological development of the individual in the earlier ages of his growth for light upon his social nature, and also upon the social organization in which he bears a part." The evidence is drawn largely from actual observation of children, and the main thought is the conception of the child's sense of personality. This is developed in Book I, which presents the person in public and private, as imitative, self-conscious, social, and inventive; his equipment, with instincts, emotions, intelligence, and sentiments; and his personal and social sanctions. The second book relates to society—the person in active and social organization—the social forces, social matter and process, and social progress. From the whole are deduced practical conclusions and rules of conduct. Some of the chapters in the second book

* *Social and Ethical Interpretations in Mental Development. A Study in Social Psychology.* By James Mark Baldwin. New York: The Macmillan Company. Pp. 574. Price, \$2.60.

were written with reference to a question set by the Royal Academy of Denmark with reference to the possibility of establishing for an individual isolated in society rules of conduct drawn from his personal nature, and the relation of such rules to those which would be reached from a consideration of society as a whole. These chapters were crowned with the gold medal of the academy.

The lectures with which Sir Archibald Geikie inaugurated the Williams lectureship in Johns Hopkins University, have been published in a book which can be read with unmixed pleasure, entitled *The Founders of Geology*.* In choosing his subject the author was moved by the thought that as his audience would include geologists from all parts of the continent and representing all departments of the science, a general topic of equal interest to all would be the best to present, and that a review of the past, with its successes and its errors, would afford valuable lessons in the future prosecution of the science. Yet it would be impossible to present the whole, even of this one phase of geology, adequately in a single course; and he therefore selected a limited period—that between the middle of the last century and the close of the second decade of the present one, an interval of about seventy years—a period which witnessed the laying of the foundations of geology. Even the whole of this period can not practically be fully covered, wherefore the author limits himself to the recital of the story of a few of the great pioneers, from whose “struggles, their failures, and their successes,” it may be indicated how geological ideas and theories gradually took shape. The first chapter treats of the cosmogonists and the beginnings of accurate and detailed observation regarding the earth’s crust and its history, with special notice of Guettard and his labors; then the rise of volcanic geology and geological travel, the history of the doctrine of geological succession, and the rise of the modern conception of the theory of the earth and of experimental geology are discussed, with notices of the leading names connected with each phase, closing with an estimate of the influence of Lyell and Darwin. From the whole the three lessons are derived of the varied employments of the most eminent leaders of the science and the small number of “professional” geologists among them; the length of time that may elapse before a fecund idea comes to germinate and bear fruit; and “the absolute necessity of avoiding dogmatism” in geology.

The existence of a rule based on astronomical considerations in the orientation of important buildings was suggested to Mr. Norman Lockyer by the observation of the direction in which the Parthenon is built, and of the many changes in the direction of the temple at Eleusis. Then he was reminded of a tradition that the eastern windows of properly constructed churches in England generally face the place of the sunrising on the festival day of the patron saint. He was thus set upon an inquiry which has been pursued for many years as to whether this is not a veritable rule, handed down from remote antiquity, and exemplified generally in temple architecture. The result of these inquiries is his book, *The Dawn of Astronomy*.† The richest field for such a study was of course found in the

* *The Founders of Geology*. New York: The Macmillan Company. Pp. 297. Price, \$2.

† *The Dawn of Astronomy*. A Study of the Temple Worship and Mythology of the Ancient Egyptians. By J. Norman Lockyer. New York: The Macmillan Company. Pp. 482. Price, \$3.

ancient Egyptian temples ; but the illustrations of the author's theory are drawn, besides these, from several other sources. The determination of the stars to which some of the Egyptian temples, sacred to a known divinity, were directed opened the way to a study of the astronomical basis of parts of the mythology—which, however, the author has wisely left to the Egyptologists to follow up. The essay begins with a review of the astronomical knowledge and ideas of the Egyptians as disclosed in their inscriptions and emblems. An attempt is then made to show that they would learn to pay special regard to certain stars and their heliacal rising as connected with their seasons, and, as they advanced in knowledge, to the equinoxes and solstices.

A study is made of six Egyptian temples which were apparently oriented with reference to the solstices, with a detailed study of the great temple of Karnak. Attention is next given to temples which appear to have been placed with reference to certain stars, in which the change of apparent position occasioned since the temples were built by the precession of the equinoxes has to be considered. Many such temples are found directed to several stars. As connected with these coincidences and essential to their rational explanation, the association of these stars with the gods of the temples is discussed, and this brings in questions of mythology, the origin of the constellations, the zodiac, sun worship, the schools of astronomy, etc. These features are compared with *data* of the Babylonian astronomy, and the origin of the whole is sought. The book is curious and suggestive, and can not fail to be helpful to all students of ancient man and the beginnings of science.

GENERAL NOTICES.

IN *Hallucinations and Illusions** the fallacies of perception are studied by Mr. Parish in the light of the data furnished by the International Census of Waking Hallucinations of the Sane. While examining the books on the general subject the author found that, as a rule, only single aspects of it were treated, such as fallacies of perception occurring under morbid conditions or in dreams, while little or no attention was given to the waking hallucinations of healthy persons; in fact, very few data had been collected to furnish the basis for an inquiry into this aspect. The requisite data have now been obtained by the International Congress of Psychology, and the subject has undergone some discussion in that body; and it has seemed a good time to review, as a preliminary inquiry, the whole field of sensory delusion, to indicate its relations to normal or "objective" perception, and to elucidate the

common organic principle which underlies alike normal and fallacious perception. This is what is undertaken in this book. Fallacious perception is considered as affected by various pathological and physiological states, and, as to the physiological process in it, its factors, contents, initiation, and manifestations, with a summary, an appendix containing narratives of waking hallucinations collected by Baron von Schrenck Notzing, tables compiled from the censuses, and indexes of authors and subjects.

For the student of Nature's humbler efforts in the mammalian line, Mr. Ingersoll's series of sketches* of the habits and ways of some of our commoner "wild neighbors" will prove instructive as well as delightful reading. The author is a well-known contributor of natural-history papers to the magazines, some of the chapters in this volume in fact being made up in part from material

* *Hallucinations and Illusions. A Study of the Fallacies of Perception.* By Edmund Parish. New York: Imported by Charles Scribner's Sons. Pp. 390. Price, \$1.25.

* *Wild Neighbors. Outdoor Studies in the United States.* Illustrated by Ernest Ingersoll. New York: Macmillan & Co. Pp. 297. Price, \$1.50.

which has previously appeared in this way. The greatly added interest and pleasure which the merest smattering of natural history gives to out-of-door rambling is not generally appreciated, and if Mr. Ingersoll's book has no other result than that of pointing the way for some amateur scientists into a field of almost inexhaustible variety and beauty it will amply justify itself. There are nine special animals and their families described, the first place being given to the squirrels. The puma or American panther, under the title of The Father of Game, is given a long chapter. An exceedingly interesting but somewhat unusual section in such a book is entitled The Service of Tails, and describes the various useful purposes served by this appendage. Among the forms discussed perhaps the most curious is that of the opossum, which serves both as a "hand rail for the young family" and as a fifth limb for the mother. Another strangely useful tail is that of the king crab or horse-shoe. It is used as a pry or lever, and seems quite essential to the preservation of the life of its owner. The hound of the plains, or American prairie wolf, is described in the fourth chapter. Other animals taken up are the badger, porcupines, the skunk, "calmly considered," woodchucks, and "coons." The sketches consist mainly of descriptions of appearance, habits, and food, with whatever of anecdote or fable the author may have found clustering about the animals among the Indians or elsewhere. The illustrations are fairly good.

Mrs. Frank's adaptation of Hauschmann's *Origin and Development of the Kindergarten System** is not strictly a translation, but rather an account of the contents of the book, with such omissions, curtailings, and transpositions as seemed necessary to render the material practically useful to kindergarten students and others interested in the training of young children. Her work has been done under the impression that no other book in kindergarten literature presents so complete

an account of the progress and development of Froebel's educational thought. "It shows what kind of a man Froebel was, and how he came to elaborate his system, and is made the medium for tracing the growth and development of the Froebel idea from its very beginnings down to the establishment of the first kindergarten." The translation has been made with Mr. Hauschmann's permission, and he has assented to the changes the translator has thought it proper to make. The curtailments consist chiefly in making as short as possible the account of certain periods in Froebel's life already in the hands of the English reader, and in summarizing some of the passages.

It does not take the serious student of French literature long to learn that it is very large and various. Much of it is also very brilliant. Each of the periods, from the middle ages down, into which criticism classifies it offers its store of books, than which no other literature exhibits a fuller one, and is distinct in its characteristics; while in every department, except poetry, it possesses works which are not excelled. A suitable and well-adapted presentation of the subject, such as Mr. Dowden* gives us, can not fail, therefore, to be a valuable and in every way desirable addition to the library of manuals. For making such a presentation the author confesses to having the most essential qualification—love of the subject. Thorough acquaintance with the whole of it he can not have, for that is beyond the power of any one man, and he especially observes that the latest attempt at its full presentation is the combined work of specialists, of whom there is one for each chapter. He, too, has had his collaborators, "the ablest and most learned students of French literature," who have written each a part of the book; but he has consulted them, not in the flesh, but on the shelves of his library. Five periods are recognized, with subordinate classifications by forms, etc.—the middle ages, of which the amount of production that has survived is astonishing; the sixteenth century, the seventeenth century, the eighteenth century, and the period from 1789 to

* The Kindergarten System : Its Origin and Development, as seen in the Life of Friedrich Froebel. Translated and adapted from the Works of Alexander Bruno Hauschmann for the Use of English Kindergarten Students. London: Swan, Sonnenschein & Co.; Syracuse, N. Y. : C. W. Bardeen. Pp. 253. Price, \$2.

* A History of French Literature. By Edward Dowden. New York : D. Appleton and Company. (Literatures of the World Series.) Pp. 444.

1850. The work closes with the decline of the romantic movement, leaving the naturalism of the present rather a subject for current criticism. Provençal literature is not included. The index is commendably full.

The *Bibliography of Education** is the outgrowth of an educational library which the author, Will S. Monroe, of the State Normal School, Westfield, Mass., has been collecting for sixteen years. When, a few years ago, he undertook to catalogue the collection, then numbering about twelve hundred volumes and pamphlets, with a view to publication for the benefit of other persons engaged in educational work, it was thought best to enlarge the list and include other works bearing on the subject. The present catalogue, the resultant of this idea, contains the titles of thirty-two hundred books and pamphlets, nearly all in the English language and obtainable in the ordinary course of trade. The exceptions to this rule are works of reference—encyclopædias and bibliographies, which are also included. The standard foreign works of reference are given, and sources of information are indicated respecting the educational literature of France and Germany. As much care has been taken to secure titles of English books as of American. The indexing of periodical literature is not attempted. The titles are grouped into classes, and these broken into sections and subsections, the shape of which has been largely controlled by the nature of the materials, and an index of twenty pages is provided.

Prof. Sylvanus P. Thompson's *Light Visible and Invisible*† is a work of real popular interest, and at the same time presents in its appendices to chapters brief discussions in exact science. It embodies the Christmas lectures delivered by the author to the people at the Royal Institution in 1896, which were liberally supplemented by experiments, and in which pains were taken to present the most recent progress in science. The wave theory is kept in special prominence, and the language is adapted to it. In the

lecture relating to the invisible light of the infra red some of the experimental points in which the demonstration of the electro magnetic nature of light rests are introduced. Having learned by his experience that polarization is not hard to understand when properly explained, the author has presented the subject "in a model way, devoid of pedantic terms, and illustrated by appropriate models." The topics treated are light and shadow, the visible spectrum, and the eye, polarization, the invisible spectrum of the ultra-violet and the infra-red, and Röntgen light. Interference and diffraction are barely alluded to, and spectrum analysis and the greater part of the subject of color vision are necessarily omitted. In the appendices to chapters the general method of geometrical optics, anomalous refraction and dispersion, the elastic solid, and the electromagnetic theories of light are briefly explained, and "other kinds of invisible light" are described or mentioned.

To the man who speculates on the origin and ultimate goal of the human race—and who of us does not?—the geological periods when we first begin to find evidence of man's existence in anything like his present form can not fail to be of exceeding interest. The treatment which the human society of these remote days usually receives is not of a popular character, although it is frequently closely allied to pure fiction. But now Mr. Stanley Waterloo has given us a novel* whose plot is laid in the time of the cave men, the earliest period from which any human remains have been obtained. The hero of the story, Ab, is one of the "great men" of his time, and the story is chiefly a history of his career. We are first introduced to him at the age of one year, the opening incident of the story recounting his narrow escape from the maw of a cave hyena, a beast which in those days was large and dangerous and a great contrast in all ways to his modern representative. The father and mother of Ab are carefully described, as well as the cave in which the family live. The cave man's probable daily life (which consisted principally of getting

* *Bibliography of Education*. By Will S. Monroe. New York: D. Appleton and Company. (International Education Series.) Pp. 202.

† *Light Visible and Invisible*. A Series of Lectures delivered at the Royal Institution of Great Britain, at Christmas, 1896. New York: The Macmillan Company. Pp. 294. Price, \$1.50.

* *The Story of Ab*. By Stanley Waterloo. Chicago: Way & Williams. Pp. 351. Price, \$1.50.

something to eat) is reconstructed, and his weapons, methods of hunting, language, and clothes are discussed. The accident by which the bow and arrow were discovered is graphically related. Methods of capturing large and small game, the variations of different tribes due to varied surroundings, and, in fact, a detailed description of the manners and customs of man in the time of the cave dwellers is worked out with considerable ingenuity and care. The book is evidently the result of a considerable study by Mr. Waterloo of geological ethnology, and will be found very entertaining by all who are at all familiar with geologic history. The psychologist will be entertained by the mentality with which the author has endowed his primitive characters. The book is also rather attractive in appearance, despite its excessively modern binding.

A third edition of Mr. *Albert H. Chester's Catalogue of Minerals Alphabetically Arranged*, and giving their chemical composition and synonyms, is published by John Wiley & Sons. The catalogue has been intended from the beginning to embrace all English names in current use in the nomenclature of mineralogy, including species, varieties, and synonyms, and omitting dead and useless names. In the present edition, which has been revised and entirely reset, all names added up to date have been inserted in their proper order.

Prof. *Clarence Moores Weed* has endeavored, in his *Life Histories of American Insects* (Macmillan Company, \$1.50), to present in a nontechnical manner the results of his observations of a few of the most interesting species, some of which he has especially studied during the last ten years; while for other sketches he has drawn upon his fellow entomologists. Among the more curious or more familiar insects thus presented and described are the crickets, walking sticks, grasshoppers, army worm, the insect of raspberry canes, insects that mark apple and oak leaves, wasps, hornets, aphides, and spiders, including "daddy longlegs." The style of the book is attractive, the descriptions are clear, and the illustrations are numerous and excellent.

Professor *Kingsley's Elements of Comparative Zoölogy* is intended as an introduction to the serious study of the subject, and em-

braces directions for laboratory work upon a selected series of animal types, together with a general account of related forms. By combining the functions of a laboratory guide and a general outline of zoölogy, it has been possible to emphasize the comparative side of the subject. But "it is not sufficient to ask one to compare a grasshopper and a beetle, pointing out their resemblances and points of difference; leading questions must be asked." Such questions are furnished, and when the student has answered them he may be supposed to have "a tolerably complete statement of the principal characters of the larger groups of the animal kingdom." Types have been selected for detailed study, partly with regard to the facility of obtaining them and partly to their adaptability to being worked out by average students, and the work has been made largely macroscopic. Laboratory work is insisted upon as the most important (H. Holt & Co., New York).

Faith or Fact, by *Henry M. Taber*, with preface by Colonel Robert G. Ingersoll (Peter Ecker, publisher, New York, \$1), is dedicated to the lovers of mental freedom, and particularly to those who have had to endure opprobrium from orthodox Christianity. It is described in the title page as "illustrating conflicts between credulity and vitalized thought, superstition and realism, tradition and verity, dogma and reason, bigotry and tolerance, ecclesiastical error and manifest truth, theology and rationalism, miracle and immutable law, pious ignorance and secular intelligence, hypocrisy and sincerity, theocracy and democracy." It is devoted to the criticism of the orthodox branch of Christianity, which the author thinks that system has invited by the course it has pursued in various respects.

Who would have imagined that the problem of the universe could be solved in a book of sixty-five small pages? Great as the task is supposed to be, that is what seems to be attempted by Mr. *John E. Atwood* in his essay on the *Constituents of the Universe* (James Edward Friend, publisher, San Diego, Cal.). The doctrine of the book, which is enlarged upon in various applications, is that "space—extent or room—and time—continuation or motion, are the three great essentials that comprise or constitute the universe";

and that all ideas of anything else existing or acting conveyed by the terms and conceptions which we in the imperfection of our knowledge and capacity have invented to account for the things we see, are false. Mr. Atwood writes as one possessed of strong convictions.

The *Annual Report of the Operations of the United States Life-Saving Service* for the year ending June 30, 1896, presents statistics exhibiting the most satisfactory results yet accomplished by the service. While the total number of disasters was greater than in any prior year, the percentage of lives and property lost was less. The average annual loss of life from 1877, when the service was generally extended to the sea and lake coasts, till June 30, 1896 (excepting the year 1878, when an exceptional mortality attended the disaster to the steamer Metropolis), has been one out of every one hundred and twelve persons on board vessels involved in disaster, and the loss of property twenty-one per cent of the value imperiled.

In his essay on *Value* (Chicago: Rand, McNally & Co., \$1) John Borden presents a sober discussion of the principles on which value is founded, with its incidents—utility, use, value, relative exchange, market, nature, and money value; to which he adds *A Short Account of American Currency*, giving its history, and a chapter on *A National Currency*. His exposition of money value is sound, simply expressed, and forcible, showing how there can be but one standard, and that representing the intrinsic value of the bullion contained in the piece, and that coinage is merely a certification that metal to that value is there, not making the value or adding to it. He differs, however, from the majority of the gold-standard men in that he insists that if there is to be paper money (which must be merely representative of actual money behind it), the Government alone should issue it.

The sixth volume of the *Proceedings of the Davenport Academy of Natural Sciences* covers the period from December, 1892, to the beginning of 1897. One of the most emphasized features observed in reading it is that it records the death of so many of the members who took part in the foundation of the academy and contributed to its

usefulness and fame. The most important papers contained in the volume are a summary of the archæology of Iowa and a bibliography of Iowa antiquities, by Prof. Frederick Starr; a list of coleoptera from the southern shore of Lake Superior, by Prof. H. F. Wickham; and a revision of the *Trexalinea* (grasshoppers) of North America, by Prof. Jerome McNeil. Shorter papers of interest relate to local and special subjects. Further, the minutes of the several meetings of the academy and the annual addresses of the presidents are given; also a portrait and biographical sketch of Prof. G. C. Parry, and a bibliography of his works.

The *Eighth Annual Report of the Missouri Botanical Garden* contains papers by William Trelease and J. Cardot, with fine plate illustrations, on the Mosses of the Azores and Madeira and botanical observations on the Azores, embodying the results of the visit of Mr. Trelease to those islands. The belief is expressed that by the system of distribution adopted, papers published in the garden reports are within the reach of more working botanists than those in any other similar publication on this side of the Atlantic. The garden suffered great damage by the tornado of May 27, 1896, and has been at considerable expense in repairing it. Plans are under consideration for making large additions to the grounds. The educational facilities offered by the garden are appreciated and utilized, but not so much as they ought to be.

Ten Noble Poems in English literature is the title of a pamphlet by J. T. Jones giving the result of a number of inquiries sent to various prominent literary people. The poems receiving the most votes were as follows: *Intimations of Mortality*; *Saul*; *Elegy written in a Country Churchyard*; *Rabbi Ben Ezra*; *Ode to a Skylark*; *Harvard Commemoration Ode*; *The Rime of the Ancient Mariner*; *Thanatopsis*; *The Eternal Goodness*; *Lines on Tintern Abbey* (Unity Publishing Company, Chicago).

In *Health of Body and Mind* (Eagle Press, Brooklyn) T. W. Topham, M. D., gives us a discussion of the ethics of disease, in which he takes the position advocated by Mr. Spencer—that the care of the body is just as much a duty as is the care of the mind; that

"disease is the result of violated law, a wrong done to Nature, and whether we are responsible for it or not, the fact remains still potent for our consideration of the greatest of all problems, that the sick man is a sinner against Nature, and that he will have to pay the penalty to the last farthing, both for his own and his ancestors' misconduct." Among special chapter headings we find the following: Why We are Sick; The Tension caused by Worry; Athletics; Self-Control; Breathing as a Means of Health; A Plea for the Baby; The Reduction of Fat; and Pain. A number of special exercises are described and pictured.

The Induction Coil in Practical Work, by *Lewis Wright* (Macmillan, \$1.25), was written, says the author, simply and solely as a practical help to the efficient and safe use of an induction coil, with some special reference to the revived and extensive use of that apparatus in surgical and physiological work with Röntgen rays. This new field of experiment has brought many into personal contact with coils who have never had any acquaintance with such instruments before, and it is thought that some will like to have a convenient outline of the many other impressive and beautiful experiments in which the induction coil bears a part. There are eight chapters which, starting with a general consideration of electrical induction, go on to a special consideration of the structure of the induction coil, its manipulation and care, the discharges in partial and high vacua, and finally spectrum work and X rays, which seem to cover the ground fairly well in an elementary way. There are numerous diagrams and several well-executed plates.

We have recently received a reprint from the eighth annual report of the Missouri Botanical Garden, entitled *Botanical Observations on the Azores*. Mr. *William Trelease*, the author, seems to have done an immense amount of work in the time which he was able to give his subject—two short leaves of absence in the summers of 1894 and 1896. The volume consists mainly of a catalogue of plants, which is followed by a very instructive series of plates.

The third annual report of the Lake Mohonk Conference on *International Arbitration* consists chiefly of the addresses delivered

at the meeting which opened on June 2, 1897. Among the speakers were the Hon. George F. Edmunds, Rev. E. E. Hale, President Dreher, Hon. E. P. Wheeler, Rev. Theodore L. Cuyler, Hon. George F. Seward, Colonel George E. Waring, Jr., Prof. U. P. Gilman, and General James Grant Wilson. The platform adopted by the meeting deplores the failure of the recent treaty between Great Britain and the United States, but rejoices at the rapid popular growth of the arbitration idea, and looks forward to the establishment in the near future of an Arbitration Commission, to which all international disputes shall be submitted.

Students of Hebrew literature and customs will be interested in the pamphlet containing tracts Shekalim and Rosh Hashana of *The Babylonian Talmud*, original text and English translation, with notes and explanations, by *Michael L. Rodkinsen*. The notes seem to be ample and satisfactory, and a great relief from the technicalities and obscurities of the text. Published in New York, 54 East 106th Street, by the New Talmud Publishing Company.

Mr. *Maximilian P. E. Groszman's Working System of Child Study for Schools* (Syra-cuse, N. Y.: C. W. Bardeen, 50 cents) is, as its title indicates, a manual of suggestions as to the method in which the study may be conducted. The author perceives that a systematic method of child study is beginning to be evolved, and shows his appreciation of the matter by declaring that the new pedagogy must be based upon it; but we must not wait until the results of all the researches have been collected, for that would be to wait a long time. There is enough material already on hand for the new education to begin at once. The author has a great advantage in that he is able to present his suggestions in the light of his experience in the New York schools of ethical culture and of the working of the methods pursued there. His precepts are re-enforced by the citation of cases which have been studied there.

"The Philosophy of the Undeniable" is the catching phrase by which Mr. *Dwight H. Olmstead* designates the doctrines contained in a booklet just issued by him (G. P. Putnam's Sons) under the title *The Prot-*

estant Faith, or Salvation by Belief. It is not, as its title might imply, a devotional treatise, but a series of arguments directed against certain time-worn dogmas still largely held by orthodox churches. Starting out with a summary of the causes of the Lutheran Reformation—"an intellectual rather than a religious movement"—Mr. Olmstead, in a few pages of terse reasoning, demonstrates that the retention of the dogma of justification by faith vitiated the entire Lutheran system, since belief and unbelief are equally involuntary, and therefore neither blameworthy nor deserving of reward. This point, he claims, strikes at the very existence of the churches, and is fatal to their present form and organization. The psychological barrier with which orthodoxy is thus confronted is further strengthened by certain ethical considerations. "Salvation," says the author, "is not a proper incentive to the performance of duty"; and "the theology that looks to the mere salvation of the soul, whether from punishment or from sin itself, can be defended neither

on principle nor, paradoxical as it may seem, on the plea of expediency; certainly not, if he be the happiest who is the most virtuous." Thus abandoning these tenets, which in the verbiage of the pulpit are called "essential truths," the author sees in the individual conscience a higher criterion of morality and a nobler guide to salvation, the conscience itself being derived from the aggregate of beliefs entertained for the time being by the individual. Here he recognizes the changeful character of all human thought, and makes provision for further development of religious belief. Although published originally nearly half a century ago, the work is still well abreast of the times, and a newly written introduction on the limitations of thought puts the book in the van of liberal thought. Mr. Olmstead has built up his thesis as if he were constructing a pyramid. His arguments are cemented with a cold and dispassionate logic which goes far to justify his own characterization of his doctrine as the Philosophy of the Undeniable.

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tode Parasites of Fishes. Pp. 24, with 8 plates.—Mearns, E. A.: Preliminary Diagnosis of New Mammals (Lynx and Mephitis) from the Mexican Boundary Line. Pp. 5; also, Preliminary Diagnosis of New Mammals (Mephitis, Dorcelaphus, and Dicotyle) from the Mexican Border. Pp. 5.—Scudder, S. H.: Revision of the Orthopteran Group Melanopli Acrididae, etc. Pp. 421, with 26 plates.

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Fragments of Science.

School Baths and Workmen's Baths in Germany.—From a long paper on the Public Baths of Europe by Dr. E. M. Hartwell, we take the following: The first public school bath in Germany was placed in a common school in Göttingen in 1883, the mayor of that city being prompted to utilize two basement rooms for the purpose through the suggestion of a professor of hygiene that the provision of well-ventilated schoolrooms was likely to be futile if they were occupied by dirty children. The cost of installation was one hundred and eighty-six dollars. The bath proved an eminent success. The example of Göttingen was followed by other cities, until it is now possible to name some forty German, Swiss, and Scandinavian cities that have introduced warm shower baths into their common schools. Certain cities, as Munich, Berlin, Frankfort, and Cologne, have adopted

the policy of placing such baths in all new schoolhouses of the class named. The development and spread of the workman's bath have also been rapid and extensive during the past few years in Germany. It seems that bath houses designed to meet the special needs of operatives were in existence in Mülhausen, in Alsace, early in the fifties. Since that time several more similar baths have been built at Mülhausen. In 1873 the firm of Friedrich Krupp erected a central bath house in its well-known steel works at Essen. The bathrooms are furnished with tubs, hot and cold water, and shower appliances. Free baths are provided in various parts of the Essen works for particular classes of workmen, as furnace men. In the Bessemer works, for instance, there is a bathroom which dates from 1893, containing shower appliances. Dr. Hartwell has compiled a list of nearly two hundred

workmen's baths said to have been established in Germany prior to 1896. In the case of school baths in Germany, the average cost of a warm shower bath is said to be one quarter of a cent, and it is safe to say that, leaving the interest on the plant out of account, the cost in the workmen's baths is about the same, or even less. The cost of the latter baths varies all the way from three hundred and fifty dollars to five thousand dollars—a very good twelve-cabin shower bath, with one hundred and seventy towels and bath caps, having been built at Dalken in the Düsseldorf district for three hundred and forty dollars. Of the great importance of cleanliness in promoting hygienic conditions, it is hardly necessary to speak, and we hope that a similar movement may spring up among the mill owners and large manufacturers in this country. The public schools are also worthy the close attention of our public-school officials.

Explosiveness of Dynamite.—From an article in *Industries and Iron*, we take the following: In the early days of dynamite the mischievous and often fatal doctrine was thoughtlessly promulgated that under the influence of fire that explosive would only burn, and that nothing would cause it to explode except the application of a proper detonator. Notwithstanding the efforts which have been made to cause the public to unlearn this foolish doctrine, it still lingers. The doctrine preached by those who know anything about the matter is that explosives are only comparatively safe at the best, and then only so long as they are treated as absolutely dangerous. There is no reliance whatever to be placed on the theory that dynamite and many of its congeners can be burned without exploding. This has been illustrated over and over again with fatal results, and the ignorance, crass stupidity, and recklessness occasionally shown by those accustomed to the daily use of high explosives are really incredible. Were the author of a highly flavored story to introduce into his plot the instantaneous death of a newly married couple by an explosion of dynamite in the stove of their sitting room, the explosion being brought about by the bridegroom's brother baking the dynamite in the oven, the author would probably be ac-

cused of going beyond the bounds of probability after the sensational, and yet this combination of circumstances did actually occur in a mining district in England. The ingenuity exercised in devising means for thawing dynamite in the most unsafe way possible is certainly very remarkable. This thawing-out process is the most fruitful cause of accidents with dynamite. The dynamite becomes inert at about 40° F., and, while this is a very valuable property for transportation purposes, it plainly also has its disadvantages. To thaw these cartridges tin warming pans constructed on the principle of the glue pot should be provided. This keeps the explosive away from any possible contact with the fire, and prevents the possibility of an excessively high temperature.

Radiography in Medical Practice.—Dr. Francis H. Williams, in an address before the Association of American Physicians, gives an interesting account of his year's work with the X rays, and shows that they must now be accepted as one of the valuable instruments in the general physician's equipment. The varying resistance which the different tissues of the body offer to the passage of the X rays depends upon difference in bulk and chemical composition. The soft tissues of the body contain a large percentage of water, so that they offer about the same resistance as an equal thickness of the latter. The rays, however, pass through air much more readily than they do through water. It is this fact which gives the X ray its special value in physical examinations of the chest. The radiograph of the normal chest shows two clearly marked out lungs, divided by a dark line representing the sternum, and crossed by dark horizontal bands, the ribs. The lower internal portion of the left lung is partially obliterated by the heart, as is also a small segment of the lower portion of the right lung. This picture is normally very sharp and unmistakable, so that any abnormal state of affairs in the lungs and any variation in the size or position of the heart are readily made out by the use of the fluoroscope. In his summary Dr. Williams claims that the X rays, and more especially the fluoroscope, have already proved to be an important addition to the ordinary methods of physical examination, and that

its use is attended with no harmful results to the patient. The complete address, with some interesting illustrations, appeared in the *American Journal of the Medical Sciences* for December, 1897.

Artesian Wells in Iowa.—The artesian field of Iowa is described by Mr. W. H. Norton as being only a part of an extensive basin which may be termed the artesian area of the upper Mississippi Valley. It includes a part of Missouri, a large part of Illinois, southern Wisconsin, and southern Minnesota. The intake of the whole field lies in the two States last mentioned. The size of the intake area is roughly estimated at about fourteen thousand five hundred square miles. With the whole Iowa field, it lies within a region of abundant rains, enjoying a mean annual rainfall of not less than thirty-two or thirty-three inches. On the basis of De Rance's estimate that one inch of rainfall per year is equivalent to 14,555,280 imperial gallons to the square mile, or a daily average of 40,000 gallons to the mile, the total annual rainfall of the collecting area of the Iowa artesian field may be estimated at about 475,000,000 gallons to the square mile, a daily average of 1,280,000 gallons or a total annual precipitation for the entire collecting area of 6,887,500,000,000 gallons. Only what of this water does not go into the streams and escape by evaporation is available for the artesian reservoir, but there is every reason for believing that that which falls over the collecting area is more than sufficient to meet all the demands made upon it by the Iowa wells.

Submarine Land Slides and Telegraphic Cables.—While the general result of denudation on the land is to bring material to a lower level, and, by gradually wearing away excrescences like mountain heights, to render such forms more stable, beneath the sea, as Prof. John Milne pointed out at the British Association, such materials are accumulated in slopes, which become unstable as the deposits grow, and facial slidings take place from time to time. The movements are caused by gravity, by subterranean springs, and by submarine earthquakes, the effects of which are at least equal to those we see produced on land, and probably greater. These

slidings, occurring along the edges of submarine banks and of the submerged continental frontier, are very damaging to telegraphic cables, which are apparently buried under large bodies of material. Sometimes two or three cables, ten or fifteen miles apart, have been destroyed by such slides. Earthquakes have been felt on land at the same moment that a cable has been broken, and the ocean has been thrown into a state of agitation for one or two days. Under very great disturbances of this kind the resultant earth movement might be recorded, with suitable instruments, at any point on the surface of the globe. In the most remarkable disturbances recorded, changes of depth up to two hundred fathoms have taken place over considerable areas. The study of these dislocations should be established on all the continents and oceanic islands.

School Sessions and Health.—In order to obtain a consensus of opinion on the subject, eight questions bearing upon the influence of our school system on the health and development of the child were addressed by Dr. E. Stuver, of Rawlins, Wyoming, to about one hundred and fifty educators and physicians of the country. Twenty-nine out of sixty-three educators and thirty out of thirty-five physicians did not think our present comprehensive course of study best calculated to develop the highest physical and intellectual powers of the child, and some of the respondents condemned these courses severely. Eighteen educators and one physician were doubtful. Respecting the proper length of continuous school sessions, the average of one hundred opinions were in favor of not longer than one hour or an hour and a half. While considerable divergence appeared concerning the limit of length of a single recitation, the majority of respondents advocated from ten to twenty minutes in the primary and from twenty to thirty minutes in the grammar grades; but much was thought to depend upon the nature of the subject of the lesson, the method of instruction, and the kind of teacher. Frequent recesses met much favor, and many respondents advised one every hour. Of one hundred and five opinions expressed as to the relative merits of open-air recesses with spontaneous play and of formal indoor exercises, all except

four were strongly in favor of outdoor exercise, or a combination of calisthenics and the old-fashioned recess. While wide divergence of opinion marked the answers of fifty-three educators and thirty-four physicians concerning the effect of home study, all insisted that the work should be carefully guarded and not carried to extremes, and that the health should be properly looked after at the same time. Some thought it did no more harm than attending parties and keeping late hours socially.

Cereal Foods.—In a recent bulletin of the agricultural experiment station at the University of Wyoming there is an interesting examination into the composition of prepared cereal foods, whose results are summed up as follows: "Leaving aside the customary claims of each food to be the best in the market, and considering only the more specific statements of composition, food value, etc., it may be said that these are in many instances entirely unreliable and misleading as to the real character of the food. . . . If purchasers of goods in packages and cans would always note the brand, and afterward buy according to the quality, it would be an encouragement to honest manufacturers, and the grade of such foods would no doubt be raised. There is more variation in price than in composition, and there is no discoverable relation between quality and price. Some articles are four or five times the cost of others of the same class, and apparently of the same merit. . . . The oatmeal sold in bulk is practically the same in composition and, so far as can be judged by personal taste, in quality and flavor as that sold in packages for several times the price. . . . The claims made for quick cooking are generally fallacious. Almost all such preparations should be cooked for at least half an hour, and usually longer, to insure the complete digestibility of the starch."

Value of Disinterested Science.—The address of President F. M. Webster before the sixth annual meeting of the Association of Economical Entomologists, on The Past and Future of Applied Entomology in America, contains an earnest argument in favor of independent investigation as against work in official bureaus and an emphatic denuncia-

tion of attempts to harness science to utility as "the worst of all the ill-matched and mis-mated combinations possible." The author regrets that the mass of mankind can not seem to comprehend that the naturalist, in order to secure results of value, "must work out his problems in a natural way, and not as a part of a machine, and that this condition is universal and one which no power on earth can change." In illustration of the value of international work in entomology, the author refers to the monetary value of the benefits this country has derived from the work of two entomologists who were sent several years ago to Australia, one of whom at least "has been able to serve his country and State better since his return," and adds that an American expert is now the official entomologist of Cape Colony, South Africa, and another is in the Argentine Republic, engaged in the investigation of some injurious insects in that country. The author sees that public opinion regarding the entomologists and their work has been changing for the better; but if this change is to continue they must do better work, the results of which will be far reaching and permanent. "The 'powers that be' over and among us must be brought to understand that science is truth and not something that is to be trifled with and debauched, or made to answer for cheap advertisements, or used for the purpose of paying political indebtedness."

Flora of the Sandwich Islands.—Isolated from a continental area, and almost equally so from the other islands of the Polynesian system, says Mr. A. A. Heller, in Minnesota Botanical Studies, Hawaiian vegetation has developed independent of extraneous modifying conditions. That it has done so in a satisfactory way is evinced in the enumeration in Hillebrand's *Flora* of 999 species of phanerogams and vascular cryptogams, of which 139 are introduced and 653 are endemic, leaving 297 species found elsewhere. Of the 653 endemic species, 250 belong to 40 endemic genera; and these are found principally among the *Rubiaceæ*, *Compositæ*, *Lobeliaceæ*, and *Labiataæ*. Besides these larger genera, there are smaller ones which have representation only on the northern islands. The great number of ferns appeal to the eye of the botanist. Omitting

the lower cryptogams, they comprise one sixth of the native vegetation. The comparative scarcity of grasses and of composite and leguminous plants, as contrasted with the unusually large number of *Rutaceæ*, *Rubiaceæ*, *Lobeliaceæ*, and *Labiataæ*, is a matter of astonishment to the collector from more temperate regions. To the student of the lower cryptogams an immense field is open. Near the summits of the mountains, and in other places where there is a large amount of moisture, the trees, bushes, and ground are draped and carpeted with mosses and liverworts. Lichens seem to be most abundant on the trees and rocks of the lower and middle regions. The "kukui" tree, which flourishes only in the lower forest region, is the host of more species of lichen than perhaps any other tree. Next comes the "koa" tree, which harbors many interesting species, but, as a rule, different from those which are found on the kukui tree. Parasitic fungi are common on the leaves and stalks of many plants, but fleshy fungi seem to be scarce. Marine algae are abundant.

Trades Unions in China.—The following facts regarding trades unions in China are taken from an abstract of Consul Charles's report in the Journal of the Society of Arts. Although labor is cheap in China, the workmen seem able to dictate their own terms. Neither masons nor carpenters begin work in winter much before 9 A. M.; in summer they knock off at noon for a long two hours' *siesta*, and at all seasons of the year smoke and drink tea, and rest whenever it suits them. According to the regulations of the builders' union, wages, if the men find their own food, are one hundred and eighty *cash* (about twelve cents) a day. These, in the case of skilled laborers, include their apprentices' wages, which are paid at the same rate. As accidents are frequent in the trade, especially among unskilled hands, the parent of the apprentice has to give an engagement in writing holding the boy's master free from all liability, but a present is expected in case of an accident. No interference is permitted with a customer's engaging any builder preferred by him. No outside firm is allowed to work, however, until it has joined the union and received a certificate, the fee for

which varies. Masters have to pay the union at the rate of about one tenth of a cent per diem for every man employed by them, to form a fund to meet subscriptions. A similar tax is levied on assistants to meet the cost of festivals, illuminations, etc. If trouble occurs between a builder and his employees and work is stopped, no other labor can be engaged in until all outstanding accounts are settled. Attendance is obligatory at meetings called to fix the quota to be paid toward subscription funds. There are but five important guilds or trade unions in China—the silk and piece goods, the banks, the sugar, the rice, and the general dealers. The members of these guilds are taxed in proportion to their business to meet the various subscriptions required from the guilds toward canal works, etc. The funds are also used for the relief of widows and orphans of former members. The whole power of trade in China rests in combination and monopoly.

Rhodesia.—Mr. F. C. Selous, who has spent twenty-five years in the country north and south of the Zambesi—in Matabeleland and Zululand—gave the British Association a favorable account of the climate of Rhodesia, and the adaptability of the highland country to white settlement. He regarded the climate as singularly favorable for the development of Europeans. He had never seen a finer race of men than the Boers and the British colonists of English, Irish, and Scotch descent, who were established in Cape Colony in 1820. They are tall, fine men, and the speaker believed that the highlands of Rhodesia would produce an equally fine race. The country includes the valleys of the Zambesi and Limpopo, where as in all African lowlands, deadly malaria prevails; and it is only the tracts four thousand feet and more above the sea level—in the elevated backbone of the country, which forms the watershed between the Zambesi and the Limpopo in the west, and the Zambesi and the Sabi in the east—that can be looked upon as likely to become peopled by white men. Possibly, as settlement advances, cultivation may gradually encroach upon the lower regions and drive the malaria from them. The superficial area of that part of Rhodesia which lies at and above an

elevation of four thousand feet extends approximately over an area of twenty-six thousand five hundred square miles, while another seventy-two thousand five hundred square miles may be added which lie between three thousand and four thousand feet. The country has suffered much of recent years, with all South Africa, from rinderpest, locusts, and drought, but more favorable conditions are hoped for, and with them anything can be grown that can be grown in Cape Colony. Wheat and oats, however, will have to be raised in the dry season with irrigation. For markets the farmer must look to the local towns, and their growth will depend upon the development of the gold prospects; and a wider market awaits the stock farmer. Matabeleland has been demonstrated to be a good cattle country. The natives formerly possessed considerable herds of sheep and goats, but these were killed and eaten during the scarcity of food. Sheep, however, seem to thrive well, as do pigs and donkeys. Well-bred fowls are subject to much disease, and the native birds are very small and lay small eggs. Horses do badly in all parts of Rhodesia. The speaker did not look upon the land as a ready-made paradise. Such a spot is hardly to be found in the unoccupied world; but "the earthly paradise of a happy home in a wild land must be created by a man's own labor, patience, intelligence, and perseverance."

Liquefied Fluorine.—The much-sought-for alkabest, or universal solvent of the ancient alchemists, is almost realized in fluorine, which was first prepared by Moissan in 1886. The transparent vessels in which it is contained have to be made of some fluoride, its action on ordinary glass being vigorous and destructive. The difficulty of handling the gas, even in the laboratory, has hence been very great, the fluoride vessels being brittle and clumsy as well as expensive. Professors Dewar and Moissan, being desirous of more fully investigating the properties of the gas, recently conducted a series of experiments at the Royal Institution, in which by means of liquid oxygen they succeeded in liquefying fluorine, and in this comparatively inert state could more fully and carefully examine its properties. The apparatus

used for liquefying the gas consisted of a small cylinder of thin glass, into the upper part of which was fused a platinum tube surrounding a smaller tube of the same material. The fluorine enters through the larger tube, passes around the glass envelope, and escapes through the smaller tube. The glass cylinder being cooled down to the temperature of boiling liquid oxygen (-183°), the current of fluorine gas was passed through the bulb without becoming liquid; at this low temperature, however, the fluorine did not attack the glass. On still further lowering the temperature of the liquid oxygen, by exhaustion, a yellow liquid was seen collecting in the glass envelope, while gas no longer escaped from the apparatus. At this moment the escape tube was closed to prevent the entrance of air, and the glass bulb soon became full of a clear yellow liquid possessed of great mobility. Fluorine thus liquefies at about -185° . The chemical activity of the gas was found greatly reduced when in the liquid state, but even then benzene or oil of turpentine underwent spontaneous decomposition when brought into contact with it. It would thus seem that the powerful affinity of fluorine for hydrogen is the last to disappear. In a subsequent experiment, in which liquid air was used and a temperature approximating -210° obtained, the liquid fluorine showed no signs of solidification. Experiments to determine its density led to the conclusion that it had about the same specific gravity as amber, 1.14. Different samples of the liquid examined with the spectroscope showed no specific absorption bands in the visible spectrum. It was found to be not magnetic.

Monazite.—Much has been said of late years, in discussions concerning the "rare earths" and the search in them for new metals, about monazite; and the mineral has obtained considerable commercial importance in consequence of its use in the manufacture of the incandescent mantles of the Welsbach light. Monazite, as described by H. B. C. Nitze in the Franklin Institute, is essentially a phosphate of the rare earth metals cerium, lanthanum, and didymium. It also usually contains small variable percentages of thorium in the form of thorite or orangite—a derivative of another rare metal, thorium. It

crystallizes in the monoclinic system, in tubular or short columnar or needle-shaped crystals, usually well developed and free from distortion, varying from microscopic size to five inches in length. It is brittle, transparent in the purest crystals, and of shades of yellow or brown in color. It is an accessory constituent of the granite rocks and their derived gneisses, and has been found in apatite, cyanite, and veined quartz, but not in sedimentary rocks. The economically valuable deposits are found in the placer sands of streams and rivers, in the irregular sedimentary sand deposits of old stream beds and bottoms, now covered up, and in the beach-sand deposits of certain seashores. Workable deposits of monazite have so far been found only in limited geographical areas. The only ones in the United States

are the placer beds in North and South Carolina; in Burke, McDowell, Rutherford, Cleveland, and Polk Counties, North Carolina, and in Spartanburg, Greenville, and York Counties, South Carolina. They occur in gravel deposits, from one to two feet thick, in streams that are seldom more than twelve feet wide. Other deposits are found in Brazil, the United States of Colombia, and Russia. The value of monazite depends on its percentage of thorium, the earth sought after by the Welsbach-light men. The Carolina beds furnished one million nine hundred thousand pounds of monazite in 1896, at from six to ten cents a pound. The next year the output fell off, both in amount and price, on account of the competition of the Brazilian field, where the production is easier and cheaper.

MINOR PARAGRAPHS.

Institute of France, Cuvier Prize.—At the session of the *Académie des Sciences* held at Paris, December 13, 1897, the Cuvier Prize of 1,500 francs was awarded to Professor O. C. Marsh, of Yale University. This prize is "awarded every three years for the most remarkable work either on the Animal Kingdom or on Geology."

The Cuvier Prize is generally regarded as the highest honor in natural science, and hitherto has been given to only two persons in this country, Agassiz and Leidy. The former, however, was a native of Switzerland, and there the special work was done for which his prize was awarded.

THE vine was once much more largely cultivated in England than it is now, and English wines were not unknown. The recent success of Lord Bute's vineyards at Castle Cook, near Cardiff, Wales, seems to favor the prospect that the grape and its products may yet, if the people take to it, win a position of importance among British industries. The vines were planted in 1875. The yield of wine has, with various fluctuations, risen from forty gallons in 1877 to forty hogsheads in 1893 and 1896; and the cost of all previous experiments was covered by the crop of 1893. That this success is not merely an accident of locality is proved by the return of a second vineyard, which was planted in another part of Lord Bute's

estate, the vines of which are thoroughly established, grow vigorously, and ripen well in most years. "We are planting thousands of vines every year, and propose to plant an acre every spring. Six hogsheads of wine were given in 1895 by the one acre in bearing condition in the new vineyard, in a season when many of the grapes and fruit and vine crops were spoiled by mildew."

CONCERNING the useful aspect of earthquake observations, Prof. John Milne said, in the British Association, that in Japan it is now clearly recognized that ordinary engineering practice as applied to embankments, piers for bridges, tall chimneys, the framing of ordinary dwellings, and other structures is to be avoided; and whenever, as, for example, after a disastrous earthquake or a fire, reconstruction is required, new methods are adopted, and the loss of life and property is being steadily reduced. The application of seismometry to measuring the irregular movements of locomotives has resulted in new forms of balancing the engines, with, among other incidents, a marked saving of fuel. By the use of seismographs along the coast of Japan submerged areas of seismic activity have been mapped through which it would be dangerous to lay a cable. Instruments which record the unfelt movements of the earth's crust sometimes tell us that cable interruption is due to earthquake action

so far from land that it can not be felt by those on shore. These instruments, wherever they are established, give information of great seismic disturbances, even when they take place at the antipodes of the place of observation. Hence they enable us to correct, confirm, and even to disprove telegraphic information.

THE peach is cultivated in Belgium grafted or budded on the red plum, which imparts much of its superior vitality to the scion. The proper calcareous quality is imparted to the soil by manuring thoroughly and applying about a bushel of lime to each tree. The trees are trained upon the sunny sides of the houses, and few houses are without trees covering their walls. To shelter the buds at the time of flowering branches cut from other green trees are placed among the upper boughs, or they are covered with mosquito netting or other material with meshes large enough to give passage to light and air; or simply devised shelters of straw are laid over them. The shields are usually placed in position about the 1st of March, and are not removed, except in cloudy weather, till all danger from frost has passed.

AMONG the curiosities of architecture described by Mr. F. T. Hodgson in *Architecture and Building* we find the following: "The Exchange building in the city of Copenhagen has attached to it a tower and spire that is one of the sights of Denmark's capital. It is one of the most remarkable examples of eccentric architecture known, although the architect in his desire for originality has not sacrificed grace of form. The lower part is octagonal in shape; but the upper part consists of four carved dragons whose tails, gracefully entwined, gradually taper away and form the spire of the Exchange. The tower and spire run up over one hundred and sixty-five feet, and the tails of the dragons are 'scaled' or imbricated, and the effect is rather pleasing. The Exchange was built in 1815."

PROF. E. RAY LANKESTER has taken the pains to contradict an assertion that he was opposed to amateurs in science. "There is not a particle of truth in it," he writes; "the members of the Marine Biological Association are mostly 'amateurs'; Darwin was an

amateur; it is rare indeed to find a professional naturalist of any merit who is not in the true sense of the term an amateur. I desire no better term to describe my relation to biological science than that of 'amateur.' My students in London and in Oxford who have been good for anything in the making of new knowledge have been 'amateurs,' and the whole body of men who have co-operated with me for thirty years in the production of the *Quarterly Journal of Microscopical Science* have been, with very rare exceptions, 'amateurs.' It is, consequently, obvious that I have never despised the efforts of amateurs on the ground that they were made by amateurs; but, on the contrary, have been occupied entirely with organizing those efforts, and in making and recording observations myself as an amateur. On the other hand, I have but little toleration for incompetence, pretense, or fraud, whether in an amateur or a professional man."

NOTES.

ONE will be impressed with the importance of good roads, Mr. John Gifford reports to the Geological Survey of New Jersey, by a visit to the forest region of Germany, where forest exploitation and road construction go hand in hand, so that inaccessible forest regions become profitable solely through the construction of excellent roads. In Germany such roads penetrate the forests in almost every direction. In certain parts of France, where a few grapevine twigs a day must serve a family for fuel, inconvenience and sometimes suffering are incurred for the lack of wood, while not far away, on the shores of the Bay of Biscay, immense quantities of excellent wood are allowed to rot, simply because a lack of roads makes the transportation of the wood unprofitable.

It is stated in a recent copy of the *London Lancet* that Professor Sanarelli has succeeded in obtaining an active immunizing serum against yellow fever. He has at present in his laboratory three dogs and two horses, well "vaccinated," which have yielded serums giving perfect immunization against experimental yellow fever in animals.

THE results of the experiments of Mr. Bokorney upon the relative antiseptic action of various substances give silver nitrate and mercuric chloride as the most effective of the inorganic compounds examined, and as having about the same value. Copper sulphate is nearly as active, and is followed by zinc sulphate and cadmium sulphate. Lead acetate and nitrate, in a one-per-cent solu-

tion, only delay decay, while it is prevented by the same strength of iron sulphide. The fluorides are not strong antiseptics.

THE working of a plan of ventilation of rooms devised by Dr. Castaing, principal physician of the French armies, was very highly spoken of by Dr. Vallin in the Academy of Sciences. It consists in having double windows, with an opening at the bottom of one of the screens and at the top of the opposite one. The air comes in freely without any one feeling it. Professor Potain spoke of the system as being excellent, on account of its simplicity, efficiency, and cheapness.

IN a circular issued from the New York Agricultural Experiment Station at Geneva, Mr. W. H. Jordan, the director, declares that the station has no connection with a scheme for establishing creameries, in the prospectuses of which its name is used, and that it does not countenance the scheme, but regards it as a fraud.

WHILE formerly the quality of water as to purity was thought to be a matter of chemistry and determinable by chemical analysis, the whole tendency of modern research has been, as Dr. A. H. Veeder has shown in a paper read before the American Microscopical Society, to cause the question of the spread of disease through the agency of water to be regarded as rather a biological one. The danger is determined by the presence of certain living organisms and of the conditions on which their continued existence depends, and not upon the quantity of them. The smallest possible inoculation may be fatal through their power of self-propagation, and there is no fixed dose. But if their growth is hindered by unfavorable conditions, they may become harmless, no matter how many of them there may be. The purification of water depends on the destruction of these organisms, or the production of conditions unfavorable to their growth.

AN unusually unpromising lot of candidates seem to have presented themselves before the Massachusetts Board of Pharmacy for certificates during the past year. There were five hundred and forty candidates, of whom only seventy-nine were passed. Of these seventy-nine, fourteen passed on the first examination, nineteen on the second, seven on the third, seventeen on the fourth, seven on the fifth, five on the sixth, and so on up to the eighteenth examination, at which the last of the seventy-nine was admitted.

THE United States Geological Survey announces in its List of Publications that, except in those cases where an extra number of any special memoir or report has been supplied by order of Congress or by the Secretary of the Interior, it has no copies of its publications for gratuitous distribution. Ap-

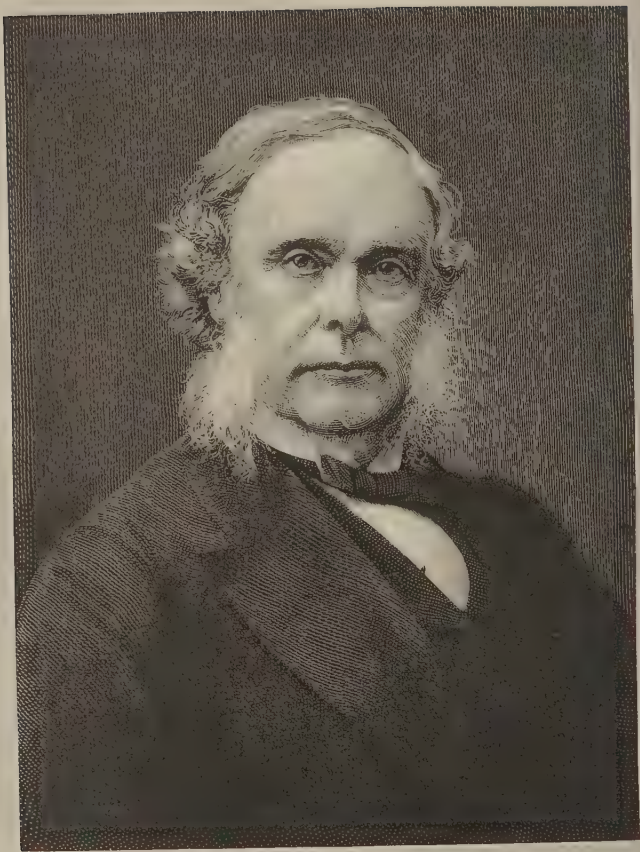
plicants for publications should give their reasons for desiring them, and the indorsement of a member of Congress is advised in all cases. Special attention is given to the requests of libraries, schools, colleges, scientific museums, associations, and societies, but they should supply full information respecting themselves. Special publications and memoirs may be secured by exchange for books that are likely to be a desirable addition to the Survey library. Publications purchased should be ordered by members, with prepayment by postal or express order—not by postage stamps, checks, or drafts.

M. RAOUL, a pharmacist of the French Marine, has just returned from Malaysia, whither he was dispatched to secure useful plants for cultivation in the French colonies, with fine collections of new textile plants, India-rubber and gutta-percha trees, and trees bearing fats, resins, and gums. He found in the interior of Sumatra gold, petroleum, and rich forests of trees of economical value. Members of the party who were bitten by serpents were cured by injections of a serum prepared by Dr. Calmette, director of the bacteriological institute of the island.

M. A. JOLY, professor of chemistry in Paris, died in December, 1897, in his fifty-second year. His principal chemical researches were made upon niobium and other rare metals, the acids of phosphorus, and hydrocyanic acid.

THE Hon. Gardiner Greene Hubbard, president of the National Geographic Society and one of the founders of Science, died near Washington, December 11, 1897, in his seventy-sixth year.

WE have to record the deaths, during the month, of Alonzo S. Kimball, since 1872 professor of physics at Worcester Polytechnic Institute, Massachusetts, December 2d, aged fifty-four years; Dr. Louis Calori, professor of anatomy in the University of Bologna, author of papers on Human and Comparative Anatomy; Dr. Wilhelm Blomstrand, professor of chemistry in the University of Lund; Dr. Nikolaus Kleinenberg, professor of comparative anatomy in the University of Palermo; Dr. Wilhelm Moericke, docent in geology at the University of Freiburg; James Bateman, botanist and horticulturist, promoter of botanical expeditions and author of Orchidaceæ of Mexico and Guatemala, and of a monograph of Odontoglossum, at Worthing, England, November 27th, aged eighty-six years; Dr. Campbell Morfitt, formerly professor of applied chemistry in the University of Maryland, in London, December 5th, aged seventy-five years; and of Dr. Ernest Hart, an active and eminent British sanitarian, editor of the Sanitary Record and the London Medical Record, formerly co-editor of the Lancet, and a contributor to the Popular Science Monthly, in his sixty-second year.



JOSEPH LISTER.

APPLETONS' POPULAR SCIENCE MONTHLY.

MARCH, 1898.

ASPECTS OF NATURE IN THE AFRICAN SAHARA. A SUMMER JOURNEY.

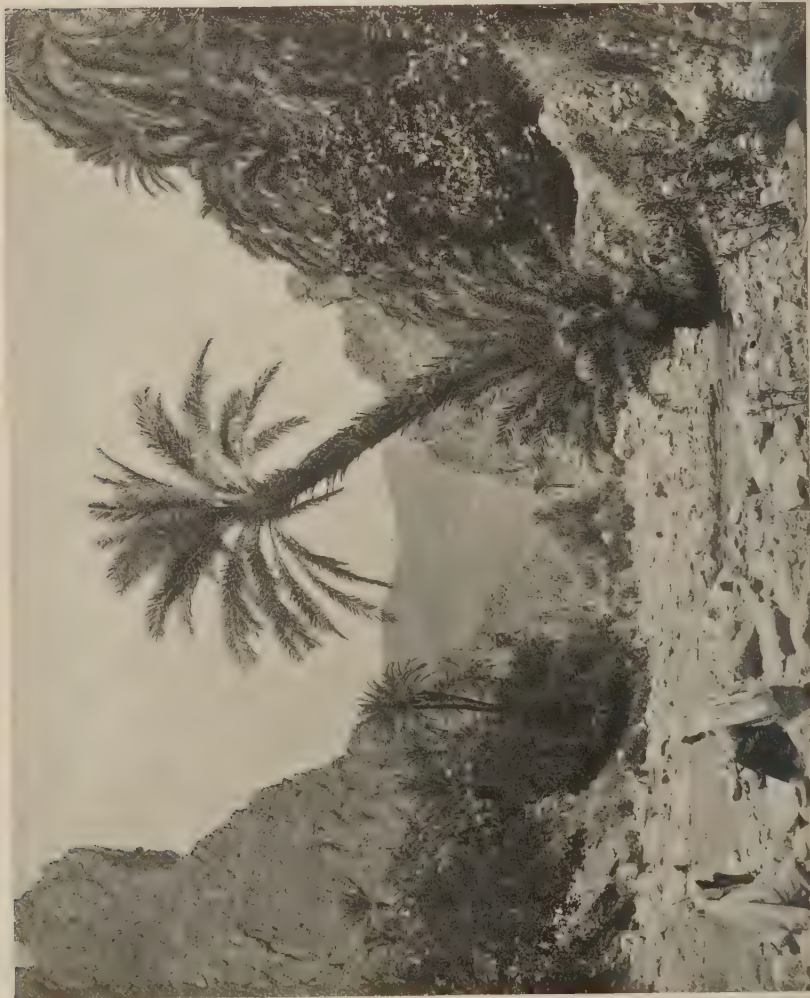
BY PROFESSOR ANGELO HEILPRIN.

I.

IT was, I believe, Fromentin, the eminent French scholar and art critic, who remarked that the sudden view of the Orient through the gateway of El-Kantara presented the most contrasting picture of life and Nature that was to be found anywhere on the surface of the earth. How nearly true this statement may be it is hardly possible to determine, but it is certain that it would be difficult to find elsewhere on the globe a more striking closing of one world and opening of another. Through El-Kantara passes the solemn tread of the camel trains, whose destination is the silent Sahara and the deeper Soudan; in it are offered up the fervent Moslem prayers for a safe journey and return. The giant buttresses of the Atlas Mountains, red and purple with the glow of the morning and twilight sun, look down upon a tempestuous mountain torrent which has cut its way athwart their core, and grim and crag-eaten rocks, buried deep within their own boulder masses, wall off with heights of three thousand to five thousand feet the gray and yellow panorama of shifting sands—the warm heart of the southern Sahara.

For years I had longed to see and feel this mysterious land—the land which had made forever famous the names of travelers who had sought to penetrate it—a land in which even to-day a “No trespass” is loudly written. Mungo Park, Denham, Clapperton, Barth, Nachtigal, and the lately deceased Gerhard Rohlfs, were heroes of my boyhood days, and now we were approaching the theater of their

exploits—not, however, in the manner of these pioneers, with a slowly pacing camel, but behind the energy of the iron horse. Let it not, however, be supposed that the passage of the locomotive through El-Kantara has revolutionized the desert; true, it has facili-



EL-KANTARA; THE GATEWAY TO THE DESERT.

tated entrance to it, and has secured a certain passageway farther into the interior. But the desert is still the desert of old; the skeletons of camels and mules lie scattered to the right and to the left—wrecks of vain effort to make the passage—the sands send back

to the sun the heat that they have received from the fiery luminary, and hordes of wandering Tuaregs, armed with gun and spear, still patrol the caravan ways that penetrate to the interior.

With all the wild, fitful, and forbidding Nature that belongs to the Sahara, it has also its elements of peace and good will. The cheer of a green oasis is, indeed, one of its first greetings, and long before the great flat expanse of sand is reached the traveler approaching from the north looks down upon an island of emerald verdure. The oasis of El-Kantara, the "first oasis" of the desert on the great caravan route leading to Lake Tchad, backs up its sea of palms to the very walls of the Great Atlas, and far into the gateway itself the feathered dates scatter themselves to meet the poplars from the north. How different, then, is this first view of the Sahara from that which the mind had pictured! It was late in the afternoon of an early September day, with the thermometer steadily rising from perhaps 92° to 98°, that we approached this land of true Africa. The bare and rugged rocks roll off from either side of us, to mingle with the almost endless wilderness of bowlders which cover the mountain foot, far off to the limits of vision. We pass caravans and parts of caravans, the swarthy children of the South contemplating our passage with at least the interest with which we drink in their picturesque garbs, the complacently meditating camels, the trains of yelping Arab curs, and children galore. How different the two modes of travel, and what feelings must the contrast inspire within the minds of these poor toilers of the desert sands!

A few days after our first approach to El-Kantara we returned to it for the purpose of better studying the character of this first oasis of the desert, and of entering into that delightful pursuit of searching for the evidences of past life in the neighborhood. We had been informed that fossils, mainly of a marine type, with beds of giant oysters, were to be found here, and, indeed, under the guidance of two Arabs who were well familiar with the region it did not take long to verify the statement that was made to us. The mountain slopes, especially where they had been furrowed into successive lines of depression and elevation, were teeming with the fossilized parts of an ancient fauna of the sea; sea urchins and oysters were particularly abundant, and their beautiful state of preservation added not a little to the delight of gathering specimens of their kind on the borders of a relentless desert.

To those who still conceive an oasis to be a gathering of a mere hundred or so of palm trees, protecting in its shade a basin of water that is hardly sufficient to quench the thirst of a few dismal-looking men and animals that may have straggled to it, the impression produced by the oasis of El-Kantara will be a pleasantly and re-

freshly disappointing one. Seen from the lower slopes of the Atlas Mountains, or from the superb roadway which French engineering science has constructed on the line of the old Roman approach to the Sahara, the oasis stretches out a charming wil-



A CORNER OF THE OASIS, BISKRA.

derness of green, the closely matted tree tufts presenting so dense a canopy of verdure that the eye fails to penetrate to the soil that gives it birth. For the better part of a mile this sea of green extends virtually unbroken, throwing up a brilliance of monochrome coloring which it would be difficult to conceive equaled. Upward of eighty thousand date palms are the main adornment of this patch of green, but let it not be supposed that they alone constitute the vegetation of the oasis. Following in the path of our guide, Ben-Labri, one of the Arab residents of the little adobe village of El-Kantara situated on the outside, we entered the wilderness of green by a tortuous, narrow passageway leading between the mud houses, and found ourselves in a garden lane of striking and refreshing beauty. The fact is that the apparently unbroken oasis is in reality a number of distinct garden areas, belonging individually to separate families of the village, each one walled off by its casing of stone or adobe, much in the manner of field properties of more civilized regions. Between these walls run the numerous dividing lanes, buried in that dark shade which elsewhere would hardly be possible except in a primeval forest. Tumbling brooks and water courses, most of the latter of artificial conduct, follow the lines of these lanes, or course over the separating gardens, giving to the numerous basins which have here and there been cut around the clumps of palms their needed quantity of water. What perhaps surprised us more than anything else in the construction of the oasis was the large number of trees and bushes other than those of a desert aspect which formed a part of the vegetation. Orange and lemon trees, figs, pomegranates, peaches, and dwarf apples were well mixed in with the palms, besides a multitude of other plants, of which our limited botanical knowledge could hardly determine the natural order. The carob, with its long, pendent pods, and the prickly pear or nopal, the distinctive cactus of northern Africa, were conspicuously noticeable by their abundance. Here and there the trailing vine hung its luscious fruit, although not with that richness and vigor which characterize the grape growth of North America generally; also an occasional dandelion brought memories to us of our own fields and meadows, an association in no way lessened through the presence of clumps of raspberry and blackberry.

Comparatively few of the date palms carry their shafts to a height exceeding fifty or sixty feet, the greater number of them probably not rising higher than twenty-five to thirty feet. They were heavily laden with brown or yellow fruit, which, of course, constitutes one of the staple articles of food to the native. We found them much too sweet for our taste, and while the fruit was always attainable, the bunches frequently hanging down to within a

few feet of the ground, we rarely availed ourselves of our opportunity. The system of irrigation that is here carried on is so perfect that, despite the excessive heat of the summer season and the three months of dry heat that had already passed, we were scarcely able to discover a dry leaf or shoot among the hundreds of thousands by which we were surrounded. This was indeed a most extraordinary aspect, and one that specially appealed to the eye looking down from a mountain elevation.

A cluster of mud or adobe houses, whose one-storied rooms lie beneath the impending leaves of the palm, constitute the Arab village to the inhabitants of which is apportioned the proprietorship of the oasis. The Arabs here are naturally not nomads, but permanent fixtures, to whom a life in the desert has little of that Africa associated with it which is the proper service of the Arab of the caravan. Under the guidance of Ben-Labri we visited a number of the houses, most of which were constituted of two or three almost entirely vacant rooms, capped by thatchings of palm leaves. In some instances a semblance of a second story was presented by a projecting veranda, on which was pitched a round tent. What little of woodwork was necessary for the support of the walls or the roof, or to outline doorways and windows, was mainly constructed from the shaft of the palm, but a rather incongruous piece of architecture occasionally carried the eye to bits or entire frames of Venetian blinds. A somewhat rarer element of construction was to be found in blocks of ancient Roman masonry, whose fanciful carvings at one time graced much more imposing structures of the desert. It must be admitted that the first inspection of the hard earth flooring of the houses, with visions of scorpions and centipeds coursing over it in wild affray, or of a lurking horned viper eagerly scanning the path of each intruder, was not immediately conducive to a real desire to share its space; but a few moments' careful study of corners and under-spaces, which brought out only wandering humpbacked ants, soon dispelled the first feeling of uncanniness which a conceived danger inspires, and with the assistance of a large mat we were soon placed at ease and comparative comfort. We visited one of the schools, where the teacher as in days of old was inculcating the doctrines of the Koran to some twelve or fifteen little barefooted urchins, and also went through the village mosque. Judiciously taking the border of the room, or in the center avoiding the holy carpet, we were allowed to enter far enough to gratify a photographer's passion, and in a few minutes' time the drop-shutter announced several pictures taken.

Surprising as from many points of view was this oasis of El-Kantara, it only cleared the way for a still greater surprise when we reached Biskra, the present terminus of the Constantine-Saharan



THE CARAVAN ROUTE TO LAKE TCHAD PASSING THROUGH BISKEA.

Railway. Biskra has not inappropriately been termed "The Pearl of the Sahara," for in truth it combines much that would tend to make almost any place attractive. Its oasis extends over a linear expanse of nearly five miles, and in its area is crowded a forest of upward of a quarter of a million of date palms, in whose shade a multitude of trees and plants of the European flora find a congenial home. Biskra also has its true gardens, which have grown up under French rule and domination, and in some of these the rustic chair and table are by no means an unpleasant association. If the truth has to be told, the heart of Biskra might just as well be a town in the interior of France as part of an African oasis. One can not, to be sure, overlook the large number of Arabs and Ethiopians who congregate everywhere in troops or marching lines, or lounge in indifferent attitudes before their not wholly lordly manors—some shouting, some bargaining, and all, with the exception of the women, practically indifferent to the presence of the stranger; but with these products of the African soil rise up the outliers of European civilization—the hotels, the *cafés*, and a number of by no means unstately mansions which constitute the home of the foreign contingent of the population. The Hôtels du Sahara, de l'Oasis, and Victoria would do credit to far more important places than this, and while, perhaps, the accommodations and comforts served by them have in a measure been Africanized, they yet provide to the traveler all that is needed by way of relaxation and sustenance.

We put up at the Hôtel du Sahara, where we found a charming hostess in the person of Madame Chabert. Under the amiable method of this lady, supported by the *plaisir* of her two daughters, we were not long in reaching the conclusion that even a summer day in the African desert can not only be made bearable but decidedly enjoyable. Our arrival in the evening did not permit us to clearly make out the exact nature of our surroundings, but sufficient was visible to indicate that in our entertainment we should be obliged to conform in part to entirely new and interesting situations. The dining room was constituted by the tunnel which opened into the street in front and the court in the rear, and its continuation was the open air-space beyond. Our part of the meal was served under the waving tufts of the date palm overhead, and it was a no mean luxury to be fed in good, old-fashioned French style in this *al fresco* corner of the garden. The thermometer at this time, about eight o'clock, covered the better part of its range of 100°, and thus, while still sufficiently high, it had already lost about sixteen degrees of its column. A steaming heat this, but nevertheless, and despite the fatigue of the day's journey, it did not feel particularly oppressive. The two delicacies that were served to us were the grape of



BOUND FOR THE SOUDAN—CROSSING THE OUTAIA.

North Africa—than which a more luscious fruit can hardly be found anywhere, not even on the volcanic slopes of the famous Hegyalya of Hungary—and ice. Unfortunately, health considerations required (or, at least, we thought that they so required) that the last-named article should be associated with some vinous or mineral water, and we therefore could not indulge in what would have been at the time one of the greatest of luxuries—ice-water.

Still early in the evening the pattering of raindrops taught us that the Sahara was even in the most heated and driest portion of the year not entirely rainless—a correction to geographical statements of a kind of which we had many to make during our African experiences. The rain was of not long duration, nor of more than feeble quality, but before it ceased it was accompanied by hail and a vivid showing of lightning in the western sky.

The sleeping apartments of this interesting hotel opened on stone corridors either in the front or in the rear; the spacious doorways, which in most cases took the place of both doorway and window, permitted of a generous exchange of inside and outside air, but it can not be said that there was enough of this to produce a really cooling effect. Even sprinkling the stone flooring of the rooms produced hardly more than a momentary relief against the pressure of a somewhat suffocating atmosphere; yet, with all, we managed to pass a sufficiently comfortable night, and one that surely was not lacking in interest as the first night in an African oasis.

Biskra lies thirty-three miles beyond El-Kantara, and therefore about this distance within the Sahara itself. To it outliers of the Great Atlas still descend, but beyond its final palm begins that almost endless expanse of gravel and sand—gently moving here into dunes and sand hills, elsewhere covering with a thin crust the underlying rock of the region—which constitutes the sandy Sahara. From any eminence in the town the eye wanders far into the wilderness of this lonely expanse—flat as the surface of the sea, more silent than the melancholy waste of the deep ocean. Biskra is elevated but three hundred and sixty feet above the sea, and from it the land gently falls away until, at the great Schott Melghigh, it is carried down seventy feet or more below the actual ocean level. It lies on the caravan route to Tuggart, Ouargla, and the central Soudan, the route which as late as 1881 saw the annihilation of the Government expedition of Flatters, and passes but little to one side of the territory of Ghadames, where was enacted the tragedy of the past year—the extermination of the exploring column of Count Moras.

It can hardly be said that Biskra is as yet what has been claimed for it, a truly charming wintering resort. If climate alone can make a place charming, it probably is such, as, apart from sand storms and

other meteorological phenomena which pertain more properly to the land surface than to the air, the winter climate of this spot is probably all that need be desired; but the oasis, and with it the town, lacks those attributes of pleasurable comfort which are needed to sustain and insure periodic change to the resting body. The kaleidoscopic sublimity of the Atlas Mountains, receiving that indescribable glow of coloring which even the painter's hand can hardly touch, entrances by its polychrome effect; the passing caravans are an interest for some days or perhaps even weeks; but the utter



THE LEADER OF A CARAVAN.

sameness of the desert beyond, its vast monotonous solitudes of resting or driving sands, begins to pall upon the mind, which seeks for change, for some relief whether of climate, life, or scene, but finds it not. It is true that in their customary way as colonizers and as seekers of the humble pleasures, the French are striving to make tenable those amusements which are a part of the habit and life of the mother country; the polo field, tennis court, and racecourse are all here, but they are not sufficient to wear away the wearisome sameness of Biskra life. Even the clamor or glamour of an Arab or Ethiopian market, especially where the

rates of sale are seemingly inordinately high, is incapable of dispelling the feeling of desert loneliness that pervades both mind and body; nor yet more conducive to hilarity is the daily visit of the "pet of the desert," the name given to a somewhat aged and feeble lion, once a monarch of the surrounding sands, which, attended or unattended, saunters about the open squares and roadways, neither disturbing the peace of the community nor in any way disturbed by it. Aged women pet it, little children fondle it, but the great mane no longer rises in wrath, nor does the bushy tail lash the body in the fury of excitement. Impending darkness has settled upon the eyes of the once noble animal, and before long it will be only a chain and scent that will direct its course. The lion was not in Biskra at the time of our visit, and we thus missed the town's most interesting inhabitant.

We remained only a few days in Biskra, but in that time sufficiently familiarized ourselves with the locality to know its most distinctive and special features. Even during the greatest heat of the day it was hardly inconvenient to follow the long lines of roadway; and where these passed within the shade of overhanging palms, or alongside the cool meandering waters of natural streams or artesian wells, there was little in the temperature to suggest that we were sightseeing in presumably very nearly the hottest part of the earth's surface and in its hottest season. During nearly all hours of the day caravans or parts of caravans file out on the long central avenue which leads through the oasis and continues across the open sand flats that follow upon the last palm. This is the great caravan route to the region of Lake Tchad. Near the southern end of the town is the Ethiopian village where one sees the life of the true African, though not the true negro—the people whom we associate with the dynasties of Egypt and Nubia, the people who constituted the followers of Cleopatra, and who probably were in the line of parentage of Cleopatra herself. It is here, as well as in the oases farther south, that one sees the stately nut-brown women who figure in the characteristic scenes of ancient Africa, their loose draperies of dark blue, their pendants of gold still hanging and glittering as in days of old. Their high earthen water pots, borne erect on the head or shoulder, still go to the well as they did thousands of years ago, and the little infant continues to cling to the mother's back, suspended in the folds of the parent's tunic.

We found these people, especially the younger women, exceedingly shy, and hardly any amount of coaxing could induce them to stand for a photograph. Sitting in front of their mud houses, rolling out corn or some manufacture from corn flour, they would rise the moment they obtained a glimpse of the camera box, and not even



BEDOUIN ENCAMPMENT IN THE SAHARA. ATLAS MOUNTAINS IN THE DISTANCE.

a free exhibition of coppers would return to the places those whom we had disturbed. We fared better with the older women, partly because they objected less to the privileges we were assuming for ourselves, and partly (perhaps it can be said mainly) because their slower movements gave us the opportunity to make a result with the instantaneous shutter.

A corner, or rather street, of Biskra which has its special attraction for the as yet rather limited number of strangers who have discovered in the oasis a true climatic resort is the Ouled-el-Nail, or "street of the dancing girls," as it is most generally known. Here congregate the Arab women, young and old, of the tribe of Nail, whose graces and *abandon* have earned for them a special reputation throughout the land. They are the "select of the select," but just why they should be considered so will probably not be apparent to most strangers. Feminine Arab beauty, despite what poets and some few travelers may have said or written about it, is not an unmitigated joy to the eye, nor that dream of loveliness toward which the artist has swung his minstrel harp. By the average European or American the Arab woman would be rated homely, if nothing more; the redeeming features of her face are the lustrous and truly exquisite eyes and the veil which hides the remaining features of her visage. Among the women of the Nail tribe, at least among those whom we had the opportunity to meet, sitting on the street curbs, lounging in the doorways, or going through their Terpsichorean antics in the coffeehouses, there was hardly a respectable feature to be seen, the worn and haggard countenances and deeply furrowed lines plainly reading the histories of their debauched lives; add to this in most cases an ungainly or warped figure, clothed in a most bizarre attire of brilliant coloring, and elaborately assisted by a veritable storehouse of jewels and gold and silver ornaments, and we have the general make-up of these nymphs of the desert. The quantity of precious plate and chains that is worn by the women is truly astonishing, the decoration of the person, manifestly, being limited only by the quantity of material that may be had to put on. We visited one of the coffeehouses where a portion of the evening was, on demand, given over to dancing, but we found the movements and the whole proceedings so slow and tiresome that we left almost immediately after we had disposed of our coffee. The coffee-house is itself—as, indeed, we found most of the native coffeehouses of the country—a model of good order, wholly relieved of riotous manner, and the very embodiment of ease and cleanliness. We enjoyed the privilege of seats, but the greater number of those present were squatted directly upon the stone or brick flooring, or upon a mat or rug that was pulled over it. Rich and poor frequent these

houses alike, and in them are usually treated to music of a not absolutely inferior quality. To say that good coffee is to be had at the native coffeehouses is stating a truism, and a condition which probably few will venture to deny. Coffee is the soul of the land, and its history a part of the history of the people themselves.

THE RACIAL GEOGRAPHY OF EUROPE.

A SOCIOLOGICAL STUDY.

(*Lowell Institute Lectures, 1896.*)

By WILLIAM Z. RIPLEY, PH. D.,

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XIV.—URBAN PROBLEMS.

THE extreme fluidity of our heterogeneous population is impressed upon us by every phenomenon of social life here in America. We imagine the people of Europe, on the other hand, after scores of generations of stable habitation, to have settled themselves permanently and contentedly into place. This is an entirely erroneous assumption. As a matter of fact, they are almost as mobile as our own American types. There are two ways in which demographic crystallization may have taken place. A people may have become rigid horizontally, divided into castes, or social strata; or it may be geographically segregated into localized communities, varying in size all the way from the isolated hamlet to the highly individualized nation. Both of these forms of crystallization are breaking down to-day under the pressure of modern industrialism and democracy, in Europe as well as in America. Nor is it true that the recency of our American social life has made the phenomena of change more marked here than abroad. In fact, with the relics of the old *régime* on every hand, the present tendencies in Europe are the more startling of the two by reason of the immediate contrast. Demographic processes are at work which promise mighty results for the future. These are not cataclysmic, like the French Revolution; but being well-nigh universal, the fact that they are slow-moving should not blind us to their ultimate effects. Such movements threaten to break up, not only the horizontal social stratification, but the vertical geographical cleavage of locality and nationality as well. Obviously any disturbance of these at once involves destruction of the racial individuality of the continent at the same time. For this reason, many phases of social analysis appertain

directly to the sphere of natural science. The anthropologist and sociologist alike are called upon to take cognizance of the same phenomena. The physical and social sciences are equally involved in the determination of their laws. Certain problems of city life are foremost among these questions, which lie on the border line between what were once widely separate sciences.*

The most conservative societies in Europe are really to-day a seething mass of moving particles, viewed with the statistical eye. To borrow a familiar figure, a great population almost anywhere is like the atmosphere; even when apparently most quiescent, in the sunlight of investigation, revealing itself surcharged with myriad motes in ceaseless agitation. These particles, microscopic or human, as the case may be, are swept along in currents, determined both in their direction and intensity by definite causes. With men, the impelling forces are reducible mainly to economic and social factors. Most powerful of these movements of population to-day is the constant trend from the rural districts to the city. Its origin is perfectly apparent. Economically it is induced by the advantages of co-operation in labor; perhaps it would be nearer the truth to say, by the necessity of aggregation imposed by nineteenth-century industrialism. This economic incentive to migration to the towns is strengthened by the social advantages of urban life, the attractions of the crowd; often potent enough in themselves, as we know, to hold people to the tenement despite the opportunity for advancement, expansion, or superior comfort afforded elsewhere outside the city walls. The effect of these two combined motives, the economic plus the social, is to produce a steady drift of population toward the towns. This has a double significance. It promises to dissolve the bonds of geographical individuality—nay, even of nationality; for a political frontier is no bar against such immigration, provided the incentive be keen enough. At the same time it opens the way for an upheaval of the horizontal or social stratification of population; since in the city, advancement or degradation in the scale of living is alike possible, as nowhere else in the quiet life of the country.

The sudden growth of great cities is the first result of the phenomenon of immigration which we have to note. We think of this as essentially an American problem. We comfort ourselves in our failures of municipal administration with that thought. This is a grievous deception. Most of the European cities have increased in population more rapidly than in America. Shaw has emphasized

* All footnote references in this article run to a Bibliography of the Anthropology and Ethnology of Europe to be published by the Boston Public Library. Full titles of all papers will be found under the proper authors and dates in that list.

the same fact in his brilliant work on Municipal Government in Europe. This is particularly true of great German urban centers.* Berlin has outgrown our own metropolis, New York, in less than a generation, having in twenty-five years added as many actual new residents as Chicago, and twice as many as Philadelphia. Hamburg has gained twice as many in population since 1875 as Boston; Leipsic has distanced St. Louis. The same demographic outburst has occurred in the smaller German cities as well. Cologne has gained the lead over Cleveland, Buffalo, and Pittsburg, although in 1880 it was the smallest of the four. Magdeburg has grown faster than Providence in the last ten years. Düsseldorf has likewise outgrown St. Paul. Beyond the confines of the German Empire, from Norway to Italy, the same is true. Stockholm has doubled its population; Copenhagen has increased two and one half times; Christiania has trebled its numbers in a generation. Rome has increased from 184,000 in 1860 to 450,000 in 1894. Vienna, including its suburbs, has grown three times over within the same period. Paris from 1881 to 1891 absorbed four fifths of the total increase of population for all of France within the same period.

Contemporaneously with this marvelous growth of urban centers, we observe a progressive depopulation of the rural districts. What is going on in our New England States, especially in Massachusetts, is entirely characteristic of large areas in Europe. Take France, for example. Most of us are aware of the distressing demographic condition of affairs in that country. One of the finest populations in Europe is almost at a standstill numerically; nay, some years show an actual decrease of population. This is not due to emigration abroad, for the French are notably backward in this respect. Nor can it be ascribed to a heavy mortality. The death rate has appreciably fallen during this century, in conformity with the great advances made in hygiene and sanitation. The marriage rate is lower than usual. Yet for some reason children do not come to cheer the land. The practical result is that Germany, the great political rival, seems destined to control the European military situation in future.† Such is the condition, viewing the country as a whole. Studying it in detail, the evil is still more magnified; for, with a stationary population for the entire country, the cities continue to grow, draining the life blood of the rural districts year by year, with ever-increasing vigor. The towns are absorbing even

* N. Brückner. Die Entwicklung der grossstädtischen Bevölkerung im Gebiete des deutschen Reichs. Allgemeines statistisches Archiv, Tübingen, i, 1890, pp. 135-184.

† We have analyzed certain of these details in French demography in Publications of the American Statistical Association, iii, 1892, pp. 248 *et seq.*

more than the natural increment of country population; they are drawing off the middle-aged as well as the young. Thus great areas are being actually depopulated. For example, in the decade from 1881 to 1891, the French cities of 30,000 inhabitants or over added to their respective numbers more than three times as many as the total increase of population for the entire country. Even their due proportion of the abnormally slow increase was denied to the rural districts; the ten years left them less densely populated than before. In 1846 almost half of the eighty-eight departments in France had a larger population than they have to-day. Paris alone, the metropolis, has, as we have already observed, absorbed four fifths of the entire increase of the land; the remainder was added to the other large cities in proportion to their size. The British Isles exemplify the same tendency. More than half of the English towns with populations over 25,000 are the product of this century. Sixty out of one hundred and five of these cities have arisen since 1825. This is, of course, due to the extension of the factory system in great measure. The same depopulation of the rural districts is noted. Ten rural counties in England and Wales alone have fewer inhabitants than in 1851. The fact is that western Europe is being gradually transformed into a huge factory town. It is being fed less and less from the products of its own territory. The wheat fields of the Americas, India, and Australia are contributing what formerly was raised by the peasantry at home. It is not surprising that the trend is toward the cities; were it even more marked it would be no marvel.

This growth of city populations has, then, taken place largely at the expense of the country. It must be so, for the urban birth rates are not enough in excess of the mortality, save in a few cases, to account for more than a small part of the wonderful growth which we have instanced. The towns are being constantly recruited from without. Nor is it an indiscriminate flocking cityward which is taking place. A process of selection is at work on a grand scale. The great majority to-day who are pouring into the cities are those who, like the emigrants to the United States in the old days of natural migration, come because they have the physical equipment and the mental disposition to seek a betterment of their fortunes away from home. Of course, an appreciable contingent of such migrant types is composed of the merely discontented, of the restless, and the adventurous; but in the main the best blood of the land it is which feeds into the arteries of city life.

Another more certain mode of proof is possible for demonstrating that the population of cities is largely made up either of direct

immigrants from the country or of their immediate descendants. Dr. Ammon, of Carlsruhe, in a most suggestive work which we have constantly cited in these pages,* has carefully analyzed in detail the populations of certain representative cities in Baden. In Carlsruhe and Freiburg, for example, he found that among the conscripts examined for military service an overwhelming proportion of the residents were either immigrants themselves or else the children of immigrants. Less than eight per cent, in fact, were the children of city-born parents—that is to say, were the outcome of three generations of continued urban residence. In a similar investigation of other German cities, Hansen found that nearly one half their residents were of direct country descent. In London it has been shown that over one third of its population are immigrants; and in Paris the same is true. For thirty of the principal cities of Europe it has been calculated that only about one fifth of their increase is from the loins of their own people, the overwhelming majority being of country birth. One direct result of this state of affairs is that cities as a rule contain more than their due proportion of middle-aged adults. They do not immigrate until they have attained majority; they do not marry till comparatively late in life, so that children and young persons form an unusually small percentage of the entire population. The aged, moreover, often betake themselves to the country after the stress of life is abated. They return to their place of birth, there to spend the last days in peace. These latter, together with those who are driven back to their homes by the fierce competitions of city life, constitute a certain feeble counter current of migration from the city outward. Yet this is insignificant compared with the inflowing tide. Thousands are yearly pouring into the towns, while those who emerge may be numbered by hundreds, perhaps even by scores. The fact is that the great majority of these immigrants either fall by the way: or else their line, lacking vitality, dwindling in numbers either through late marriages and few children, or else the opposite extreme of overproduction and abnormal mortality, comes to naught in a few generations. Thus the steady influx of immigration goes on. Truly, cities are, as has been observed, “consumers of population.” Our problem here is to determine whether such consumption is being applied equally to all our racial types; if not, the future of Europe, ethnically, can not but be profoundly affected. The future character of European peoples will be largely determined by this circumstance. From the point of view of relative increase, the German nation is undoubtedly in the lead, especially as compared with the

* *Die natürliche Auslese beim Menschen.* Jena, 1893.

French. Equally important, however, is it to consider the relative destruction which is annually being waged. If, as is asserted, these prolific Teutons are pre-eminently a city type, and if thereby they lay themselves open to decimation, the future balance of power in Europe may not be so completely disturbed after all.

These various social phenomena have been most ably correlated in a rather suggestive broad-line sketch of a mode of social selection given by Hansen.* Basing his hypothesis upon data derived in the main from the cities of Germany, he distinguishes in any given population what he designates as three degrees of vital and psychic capacity respectively. The vitality is measured in each class by the ratio of the birth to the death-rate. The first vitality rank consists of the well-to-do country people, leading a tranquil existence, healthy in mind and body, free alike from dread or aspiration. This class increases rapidly by birth, and loses relatively few by premature mortality. It has enough and to spare in numbers. Both country and city alike depend upon it for future growth. Below this is a second vitality rank, composed of the middle classes in the towns. Herein we find a somewhat lower birth rate; ambition and possibility of social advancement become effective in limiting the size of families. Coincident with this is a low death rate, owing to material comfort and a goodly intelligence. This class holds its own in numbers, perhaps contributes slightly to swell the census returns from year to year. Below this lies the third vitality rank, composed of the great mass of the urban populations, the unskilled labor and the poorer artisans. Here occur an abnormally high birth rate, little self-restraint, and, through ignorance and poverty, an inordinately high rate of mortality. This is the portion of the city population continually recruited from the country or through rejects from the superior classes—those, that is to say, who fail in the intense competition of the upper grades of society. Measured by vitality alone, it would appear that the first rank we have described—the average country population—were the ideal one. Applying, however, the tests of intellectual capacity, Hansen discovers curious cross-cleavages. For the country population is being continually drained of its best blood; those who are energetic or ambitious in the majority of cases leaving their homes to seek success in the city. Thus an intellectual residuum is left on the soil, representing merely the average intelligence; perhaps, if near a great metropolis, even falling below the normal in this respect. Those in their turn who emigrate to the towns are speedily sorted by inexorable fate. Some achieve success; the majority perhaps go

* *Die drei Bevölkerungsstufen.* München, 1889.

to swell the other middle classes; or else, entirely worsted in the struggle, land in a generation or two in the lowest ranks of all. Thus a continual tide of migration becomes necessary to insure stability in numbers in the entire population. This ingenious scheme, too simple of course to be entirely correct, as Giddings has suggestively pointed out,* does nevertheless contain a germ of truth. Our problem is to test its applicability to modern conditions by a study of purely anthropological facts.

The first physical characteristic of urban populations, as compared with those of country districts, which we have to note, is their tendency toward that elongated shape of head which is characteristic of two of our principal racial types, the Teutonic and the Mediterranean respectively.

It seems as if for some reason the broad-headed Alpine race was distinctly a rural type. This we might have expected from the persistency with which it clings, as we have seen, all over Europe, to the mountainous or otherwise isolated areas. Thirty years ago an observer in the ethnically Alpine district of south central France noted an appreciable difference between town and country in the head form of the people.† In a half dozen of the smaller cities his observations pointed to a greater prevalence of the long-headed type than in the country round about. In the same year, in the city of Modena in Italy, investigations of the town and country populations, instituted for entirely different purposes, brought the same peculiarity to light.‡ These facts escaped notice, however, for about a quarter of a century. In entire ignorance of them, in 1889, a gifted young professor in the university at Montpellier in southern France, having for some years been occupied in outlining various theories of social selection, stumbled upon a surprising natural phenomenon.* On examination of a considerable series of skulls, dating from various periods in the last two hundred years, which had been preserved in crypts at Montpellier, he found that the upper classes, as compared with the plebeian population, contained a much larger percentage of long-headed crania. These crania of the aristocracy, in other words, seemed to conform much more nearly to the head form of the Teutonic race than those of the common people. Additional interest was awakened in the following year by the researches of Dr. Ammon, of Carlsruhe, who, working again in entire independence upon measurements of thousands of conscripts of the Grand Duchy of Baden, discovered radical differences

* *Principles of Sociology*, pp. 342 *et seq.*

† Durand de Gros, 1868 a, p. 228, 1868 b, and 1869.

‡ Calori, 1868; Lombroso, 1878, p. 123; Riccardi, 1883; and Livi, 1886, p. 274, have since confirmed it.

* Lapouge, 1889 b.

here between the head form in city and country, and between the upper and lower classes in the larger towns.* Several explanations for this were possible. The direct influence of urban life might conceivably have brought it about, acting through superior education, habits of life, and the like. There was no psychological basis for this assumption. Another tenable hypothesis was that in these cities, situated, as we have endeavored to show, in a land where two racial types of population were existing side by side, the city for some reason exerted superior powers of attraction upon the long-headed race. If this were true, then, by a combined process of social and racial selection, Carlsruhe, Freiburg, Mannheim, and the other towns would be continually drawing unto themselves that tall and blond Teutonic type of population which, as history teaches us, has dominated social and political affairs in Europe for centuries. This suggested itself as the probable solution of the question; and investigations all over Europe during the last five years have been directed to the further analysis of the matter. This was not an entirely new discovery even for Germany; the same fact had been previously noted in Würtemberg, that the peasantry were noticeably rounder-headed than the upper classes.† Yet Ammon undoubtedly first gave detailed proof of its existence, basing it upon a great number of physical measurements; and he undoubtedly first recognized its profound significance for the future. To him belongs the honor of the discovery of the so-called "Ammon's law," that the Teutonic race betrays almost everywhere a marked *penchant* for city life. This is all the more surprising as Tacitus tells us that the ancient Germans, unlike the Italians, were strongly imbued with a hatred of communal existence. We have no time to give in detail all the evidence which has been accumulated in favor of its validity. The fact of greater frequency of the long-headed type in town populations, as compared with rural districts, has been established by Lapouge in a great number of investigations all through central and southern France‡ and in Brittany.* Collignon, foremost authority upon the physical anthropology of France, gives in his adherence to it as a general rule, finding it applicable to Bordeaux and nearly all the cities of the southwest.|| It seems to hold true in Vienna, which with its suburbs forms a little islet of Teutonic long-headedness in Austria.△ In northern Italy the long-headedness is quite universally more prevalent in all

* Ammon, 1890; and 1893, p. 72.

† Von Hölder, 1876, p. 15.

‡ Lapouge, 1894, p. 483; 1896 a, p. 401; 1897. Closson has presented his work most acceptably to English readers.

* Lapouge, 1896 b, p. 91; also, Muffang, 1897.

|| 1895, pp. 123-125; see also table in 1894 b, p. 19, on Limoges.

△ Weisbach, 1895 b, p. 77, map.

the cities, although the opposite is more often true south of Rome.* It is true of Paris and Lyons especially, the department of the Seine being well below the average for France and for the neighboring departments.† In Spain the only indication of the law is offered by Madrid, where nearly seven hundred conscripts have been measured in detail.‡ In this latter country, as in the British Isles,§ and in southern Italy, as we have observed, everywhere in fact on the outskirts of Europe where the Alpine broad-headed race is but sparsely represented, we find the contrasts in head form between city and country absent in great measure. Observations on four hundred and eighty-seven American college students have not yielded me any differences in this respect. Only where the Alpine race forms an appreciable element in the population does "Ammon's law" appear to hold true.

The circumstance which we have mentioned, that only in those portions of Europe where the Alpine broad-headed type is strongly in evidence do we find a more prevalent long-headedness in the city populations, suggests a criticism upon the somewhat extravagant claims to the universality of "Ammon's law," made by ardent disciples of the school of so-called "anthropo-sociologists." It is this: City populations are the inevitable result of great intermixture of blood; they of necessity contain a hodge-podge of all the ethnic elements which lie within the territory tributary to them, which, in other words, lie within what Lapouge has aptly termed their "spheres of attraction."|| As a whole, one should not expect to find the extreme individuality of type in the cities, which can persist alone in the isolated areas free from ethnic intermixture. If, as in Baden, in Brittany, or along the Rhône Valley, an extremely broad-headed type of population is localized in the mountains, as we know it is all over Europe; while along the rivers and on the seacoast are found many representatives of an immigrant Teutonic long-headed people; it would not be surprising that cities located on the border line of the two areas should contain a majority of human types intermediate between the two extremes on either side. These city populations would naturally be longer-headed than the pure Alpine race behind them in the mountains, and coincidentally broader-headed than the pure Teutons along the rivers and on the seacoast. The experience of Italy is instructive. In this country the transition from a pure Alpine broad-headed population in the north to an equally pure and long-headed Mediterranean type in the south is

* Livi, 1896 a, pp. 87-89, 147, 148, 151, 159, and 187.

† Lapouge, 1897, p. 70.

‡ Oloriz, 1894 b, pp. 47 and 279; also pp. 173 and 224.

* Beddoe, 1894, p. 664.

|| This point I have discussed at length, borrowing largely from Livi's superb work on Italy, in the Publications of the American Statistical Association, v, 1896, pp. 37 *et seq.*

perfectly regular, as our maps in the October (1897) number of this series have made manifest. It has been established that while the cities in the north are less broad-headed than the country, in mid-Italy no appreciable difference between the two exists; and in the south, the cities being ever nearer the mean for the country as a whole, actually contain fewer long-headed individuals than the rural districts. This consideration, which no statistician can fail to keep in mind, seems, however, to be insufficient to account for the entire phenomenon, especially north of the Alps. We are forced to the conclusion, in other words, that there is some mental characteristic of the long-headed race or types, either their energy, ambition, or hardiness, which makes them peculiarly prone to migrate from the country to the city; or else, what would compass the same result, a peculiar disinclination on the part of the broad-headed Alpine race of central Europe thus to betake itself to the towns. The result in either case would be to leave the fate of the urban populations to be determined more and more by the long-headed type.

A second mode of proof of the peculiar tendency of the long-headed type to gravitate toward the city is based upon the detailed study of individuals, tracing each person from his place of birth, or from generation to generation from the rural origin to the final urban residence. Dr. Ammon divided his conscripts into three classes: The *urban*, those whose fathers were of city birth, as well as themselves; the *semi-urban*, comprising those born in cities, but whose fathers were immigrants from the country; and, thirdly, the *semi-rural* class, who, born in the country, had themselves taken up an abode in the city. Comparing these three classes with those who were still domiciled in the country, a regularly increasing long-headedness was apparent in each generation. Lapouge and his disciples in France are now collecting much valuable information upon this point which can not fail to be suggestive when accumulated in sufficient amount. Everything goes to prove a slight but quite general tendency toward this peculiar physical characteristic in the town populations, or in the migratory class, which has either the courage, the energy, or the physical ability to seek its fortunes at a distance from its rural birthplace.

Is this phenomenon, the segregation of a long-headed physical type in city populations, merely the manifestation of a restless tendency on the part of the Teutonic race to reassert itself in the new phases of nineteenth-century competition? All through history this type has been characteristic of the dominant classes, especially in military and political, perhaps rather than purely intellectual, affairs. All the leading dynasties of Europe have long been re-

cruited from its ranks. The contrast of this type, whose energy has carried it all over Europe, with the persistently sedentary Alpine race is very marked. A certain passivity, or patience, is characteristic of the Alpine peasantry. This is true all the way from north-western Spain, where Tubino (1877) notes its degeneration into morosity in the peasantry, as far as Russia, where the great inert Slavic horde of northeastern Europe submits with abject resignation to the political despotism of the house of the Romanoffs. Ordinarily a negative factor in politics, always socially conservative, this race when once aroused becomes irresistible. As a rule, not characterized by the domineering spirit of the Teuton, this Alpine type makes a comfortable and contented neighbor, a resigned and peaceful subject. Whether this rather negative character of the Alpine race is entirely innate: or whether it is in part, like many of its social phenomena, merely a reflection from the almost invariably inhospitable habitat in which it has long been isolated, we may not pretend to decide.

The peculiar temperament of the Alpine population comes to the surface in political affairs, being attested by great conservatism. This reactionary instinct is in the long run far more common to all human nature, I believe, than is generally supposed; in the Alpine Celt it is developed or conserved, if you please, to a marked degree. Socially, the peculiarities of disposition we have mentioned are of even greater importance, as we sought to impress in our preceding article. In fact, the future of the type depends largely upon this circumstance. The most persistent attribute of the Alpine Celt is his extreme attachment to the soil, or, perhaps, better, to locality. He seems to be a sedentary type *par excellence*; he seldom migrates, except after great provocation; so that, once settled, he clings to his patrimony through all persecution, climatic or human. If he migrates to the cities, as does the "mobile" Teuton, he generally returns home to the country to spend his last days in peace. Such re-emigration of the Alpine type late in life is in fact offered by Collignon* as the main explanation for the prevalence of the long-headed variety in the towns to-day. He inclines to this view rather than to the theory that it is due to the greater number of the immigrant Teutons, as Ammon and Lapouge are disposed to maintain. At all events, whichever explanation be true, the fact that mental differences between our racial types exist, if they become accentuated with the ever-increasing pressure of civilization, can not but profoundly affect the future complexion of European populations. A phase of racial or social competition of such

* 1895, p. 125.

magnitude that we hesitate to predict its possible effects, is at once suggested.

Let us now for a moment take up the consideration of a second physical characteristic of city populations—viz., stature. Some interesting points are concerned herein. The apparently contradictory testimony in this respect becomes in itself highly suggestive, I think, for the student of social problems. A few of the older observers found that city populations sometimes surpassed those of the country in the average of bodily height. Thus Quetelet* and Villermé (1829) discovered such a superiority of stature in the Belgian cities, amounting to several centimetres. From this coincidence Quetelet derived a law to the effect that the superior advantages of urban residence were directly reflected in the physical development of the people. This hypothesis is now definitely disproved by all the data available. If there be a law at all in respect of average statures, it demonstrates rather the depressing effects of city life than the reverse. For example, Hamburg is far below the average for Germany;† Dunant (1867) finds it true in Geneva; Pagliani observed it in Turin. The city of Madrid contains almost the shortest male population in all Spain; only one province, Valladolid, standing slightly below it. Residents of its poorer quarters are absolutely the shortest in the entire peninsula.‡ All over Britain there are indications of the same law, that town populations are on the average comparatively short of stature. The townsmen of Glasgow and Edinburgh are four inches or more shorter than the country folk roundabout, and thirty-six pounds on the average lighter in weight.* Dr. Beddoe, the great authority upon this subject, concludes his investigation of the population of Great Britain thus: "It may therefore be taken as *proved* that the stature of men in the large towns of Britain is lowered considerably below the standard of the nation, and as *probable* that such degradation is hereditary and progressive.|| Not all authorities are able to find such differences, especially in the less industrially developed portions of Europe; as in Hungary, where Scheiber[^] could detect no variation between city and country at all. Ammon, in Baden, alone among modern observers, finds a higher average stature in the cities. He ascribes it to greater frequency of the tall Teutonic type.¶ Nevertheless, the trend of testimony is in favor of Beddoe's view, as a rule; especially when applied to the great modern factory towns,

* 1869, p. 33.

† Meisner, 1889, p. 116. Reischel, 1889, pp. 139–142, notes it of smaller cities, as in Erfurt. ‡ Olóriz, 1896, pp. 42 and 60.

* British Association, Anthropometric Committee Report, 1883, pp. 273 *circa*.

|| 1867, p. 180.

[^] 1881, p. 254.

¶ 1893, p. 116.

where contributory influences, such as professional selection and the like, come into operation.*

A most important point in this connection is the great variability of city populations in size. All observers comment upon this. It is of profound significance. The people of the west and east ends in each city differ widely. The population of the aristocratic quarters is often found to exceed in stature the people of the tenement districts. Manouvrier (1888) has analyzed the Parisians most suggestively in this respect, giving a map to show his results. In Madrid also it appears that the well-to-do people are nearly two inches taller on the average than the residents of the poorer quarters.† We should expect this, of course, as a direct result of the depressing influence of unfavorable environment. Yet there is apparently another factor underlying that—viz., social selection. While cities contain so large a proportion of degenerate physical types as on the average to fall below the surrounding country in stature, nevertheless they also are found to include an inordinately large number of very tall and well-developed individuals. In other words, compared with the rural districts where all men are subject to the same conditions of life, we discover in the city that the population has differentiated into the very tall and the very short. This is true in Hamburg; ‡ it holds good in many of the cities of Switzerland, especially in Basle,* where it has been found that the percentage of tall men, over five feet seven inches in height, is nearly twice that in the country roundabout. At the same time the stunted individuals are in the same city two and a half times as frequent as outside the city walls. In Modena a similar frequency of very tall men has been noted.|| The explanation is simple. The tall men are in the main those vigorous, mettlesome, presumably healthy individuals, who have themselves, or in the person of their fathers, come to the city in search of the prizes which urban life has to offer to the successful. On the other hand, the degenerate, the stunted, those who entirely outnumber the others, so far as to drag the average for the city as a whole below the normal, are the grist turned out by the city mill. They are the product of the tenement, the sweat shop, vice, and crime. Of course, normally developed men, as ever, constitute the main bulk of the population; but these two widely divergent classes attain a very considerable representation. As an example of the influence of such selection, Dr. Beddoe remarks upon the noticeably short stature of all the

* These we have heretofore analyzed in our article on Stature in the May (1897) number of this present series.

† Olóriz, 1896, pp. 42 and 61.

‡ Meisner, 1889, p. 120.

* Chalumeau, 1896 a, p. 7.

|| Riccardi, 1882, pp. 249-253.

agricultural counties about London, being even less than in the metropolis itself.* On the other hand, the Anthropometric Committee of the British Association for the Advancement of Science,† measuring more among the upper classes in London, found them to exceed both in height and weight the peasantry in Hertfordshire, near by. This need not disprove Dr. Beddoe's assertion. In fact, the contradictory evidence is very valuable for that reason. The only way to account for it is to suppose that the constant draft upon these suburban populations for their most powerful men, for service in the neighboring city as policemen, porters, firemen, and in other picked professions, has depleted the land of all its best specimens. Such an inflowing current always tends cityward. Everything points to the conclusion, on the other hand, that the final product of the continued residence of such sorted populations in the city is to divide them into the chosen few who succeed and rise socially, and the many who descend, in the social scale as well as in stature, until their line becomes extinct. As they differentiate thus, they migrate within the city. The few drift toward the West End, toward the Champs Elysées or Fifth Avenue, where they maintain the high physical standard of the quarter; the others gravitate no less irresistibly toward Cheapside and the Bowery.

We have seen thus far that evidence seems to point to an aggregation of the Teutonic long-headed population in the urban centers of Europe. Perhaps a part of the tall stature in some cities may be due to such racial causes. A curious anomaly now remains, however, to be noted. City populations appear to manifest a distinct tendency toward brunetteness—that is to say, they seem to comprise an abnormal proportion of brunette traits, as compared with the neighboring rural districts. The first notice of this is due to Mayr.‡ who, studying some 760,000 school children in Bavaria, stumbled upon it unexpectedly. Although blondes were in a very decided majority in the kingdom as a whole, the cities all contained a noticeable preponderance of brunette traits. This tendency was strikingly shown to characterize the entire German Empire when its six million school children were examined under Virchow's direction.* In twenty-five out of thirty-three of the larger cities were the brunette traits more frequent than in the country. In Metz alone was there a decided preponderance of blondes, due perhaps to the recent Germanization of Alsace-Lorraine as a result of political circumstances. Broadly viewed, all the larger cities, dating from the period prior to 1850, showed this brunette peculiarity in their school children.

* 1867, p. 178.

‡ 1875, pp. 299 and 305, with tables.

† 1883, p. 20.

* 1885 and 1886 b, pp. 320 *et seq.*

Quite independently Dr. Beddoe discovered the same fact in the Rhine cities, basing his conclusions, however, entirely upon adults.* Here again, as in the case of the head form, we must reckon with the fact that city populations are always, by reason of intermixture, a mean, intermediate between the extremes presented by the country at large. So in northern blond Hanover the cities should contain more dark traits than the country; in Bavaria, on the contrary, we should expect them, for this same reason, to be somewhat more blond. Nevertheless, this would not account for the dark hair in certain Prussian cities, which contain more than twice as many dark as there are light traits; and in Bavaria, as we have seen, the actual condition is exactly the reverse of what might have been statistically expected.

Austria offers confirmation of the same tendency toward brunetteness in twenty-four out of its thirty-three principal cities.† Farther south, in Italy, it was noted much earlier that cities contained fewer blondes than were common in the rural districts round about.‡ The rule has been corroborated for the greater part of the country, since Livi* finds that even in the thirty-two darkest provinces, where towns tending toward the mean for the country should contain more blondes than the suburban districts, twenty-one of the capital cities show the reverse relation, while only nine conform to statistical probability. For Switzerland alone the evidence is conflicting.|| Applying the rule to the cities of the British Isles, Dr. Beddoe finds it to hold good especially in the color of the hair.△ So uniform is the testimony in this direction that those who, like Ammon◇ and Lapouge,‡ have ascribed the long-headedness of city populations to a predominance of the Teutonic racial type, now acknowledge this tendency toward brunetteness in spite, in this case, of ethnic probabilities to the contrary. The relative frequency, in fact, of long-headedness and coincidently of brunette characteristics induced Lapouge to designate this combination the "foreordained urban type."‡ In conclusion, let us add, not as additional testimony, for the data are too defective, that among five hundred American students at the Institute of Technology in Bos-

* 1885, p. 211.

† Schimmer, 1884, p. xiii. For Tyrol, see comparative table in Toldt, 1894, and Virchow, 1886 b, p. 379.

‡ Raseri, 1879, p. 118.

* 1896 a, pp. 70 *et seq.*

|| Studer, 1880, p. 59, says it holds good in Berne. Kollmann, 1883, p. 17, and Chalumeau, 1896 a, p. 8, affirm the cities to be more blond.

△ 1893, p. 114. See also tables in 1885, p. 160.

◇ 1896 d, p. 796. Ammon, 1893, p. 99, found dark hair more frequent in cities in Baden, but in eyes more variation.

‡ 1897, p. 85.

‡ Collignon, 1895, p. 123, apparently acquiesces in this view.

ton, roughly classified, there were nine per cent of pure brunette type among those of country birth and training, while among those of urban birth and parentage the percentage of such brunette type rose as high as fifteen. The arbitrary limit of twenty thousand inhabitants was here adopted as distinguishing city from suburban populations. Dark hair was noticeably more frequent in the last named group.

It is not improbable that there is in brunetteness, in the dark hair and eye, some indication of vital superiority. If this were so, it would serve as a partial explanation for the social phenomenon which we have been at so much pains to describe. If in the same community there were a slight vital advantage in brunetteness, we should expect to find that type slowly aggregating in the cities; for it requires energy and courage, physical as well as mental, not only to break the ties of home and migrate, but also to maintain one's self afterward under the stress of urban life. Selection thus would be doubly operative. It would determine the character both of the urban immigrants and, to coin a phrase, of the urban *persistents* as well. The idea is worth developing a bit.

Eminent authority stands sponsor for the theorem that pigmentation in the lower animals is an important factor in the great struggle for survival.* One proof of this is that albinos in all species are apt to be defective in keenness of sense, thereby being placed at a great disadvantage in the competition for existence with their fellows. Pigmentation, especially in the organs of sense, seems to be essential to their full development. As a result, with the coincident disadvantage due to their conspicuous color, such albinos are ruthlessly weeded out by the processes of natural selection; their non-existence in a state of Nature is noticeable. Darwin and others cite numerous examples of the defective senses of such non-pigmented animals. Thus, in Virginia, the white pigs of the colonists perished miserably by partaking of certain poisonous roots which the dark-colored hogs avoided by reason of keener sense discrimination. In Italy, the same exemption of black sheep from accidental poisoning, to which their white companions were subject, has been noted. Animals so far removed from one another as the horse and the rhinoceros are said to suffer from a defective sense of smell when they are of the albino type. It is a fact of common observation that white cats with blue eyes are quite often deaf.

Other examples might be cited of similar import. They all tend to justify Alfred Russel Wallace's conclusion that pigmenta-

* Dr. William Ogle, in *Medico-Chirurgical Transactions*, liii, 1870, pp. 263 *et seq.*

tion, if not absolutely necessary, at least conduces to acuteness of sense; and that where abundantly present it is often an index of vitality.* This eminent naturalist even ventures to connect the aggressiveness of the male sex among the lower animals with its brilliancy of coloring.

Applying these considerations to man, evidence is not entirely wanting to support De Candolle's (1887) thesis that "pigmentation is an index of force." Disease often produces a change in the direction of blondness, as Dr. Beddoe has observed; asserting, as he does, that this trait in general is due to a defect of secretion. The case of the negro, cited by Ogle, whose depigmentation was accompanied by a loss of the sense of smell, is a pertinent one. The phenomenon of light-haired childhood and of gray-haired senility points to the same conclusion. A million soldiers observed during our civil war afforded data for Baxter's† assertion that the brunette type, on the whole, opposed a greater resistance to disease, and offered more hope of recovery from injuries in the field. Dr. Beddoe finds in Bristol that the dark-haired children are more tenacious of life, and asserts a distinct superiority of the brunette type in the severe competitions induced by urban life.‡ It is not for us to settle the matter here and now. The solution belongs to the physiologist. As statisticians it behooves us to note facts, leaving choice of explanations to others more competent to judge. It must be said in conclusion, however, that present tendencies certainly point in the direction of some relation between pigmentation and general physiological and mental vigor. If this be established, it will go far to explain some of these curious differences between country and city which we have noted.

From the preceding formidable array of testimony it appears that the tendency of urban populations is certainly not toward the pure blond, long-headed, and tall Teutonic type. The phenomenon of urban selection is something more complex than a mere migration of a single racial element in the population toward the cities. The physical characteristics of townsmen are too contradictory for ethnic explanations alone. A process of physiological and social rather than of ethnic selection seems to be at work in addition. To be sure, the tendencies are slight; we are not even certain of their universal existence at all. We are merely watching for their verification or disproof. There is, however, nothing improbable in the phenomena we have noted. Naturalists have always turned

* Address in Transactions of the British Association for the Advancement of Science, 1873, pp. 100 *et seq.*

† 1875, i, pp. 61 and 72.

‡ 1885, p. 223, and 1893, p. 115.

to the environment for the final solution of many of the great problems of Nature. In this case we have to do with one of the most sudden and radical changes of environment known to man. Every condition of city life, mental as well as physical, is at the polar extreme from those which prevail in the country. To deny that great modifications in human structure and functions may be effected by a change from one to the other is to gainsay all the facts of natural history.

Our long series of articles now draws to a close. It has been shown with what infinite pains, slowly through hundreds of generations, human beings in Europe have been shaping themselves to the conditions imposed by Nature. We have followed men in their migrations over the face of the continent; we have analyzed the forces making for change, which have played upon them; we have seen how tenaciously they have clung to the type of their ancestors throughout all the vicissitudes of ages. Whether twentieth-century urban life, with all the social changes which it implies, will finally eradicate all traces of ethnic descent remains to be seen. Certainly the pages of ethnic history, written in man's physical constitution, are rapidly blurring before our eyes. To be deciphered at all, they require the instant attention of European scientists. As for us in America, our field of investigation is mapped out with equal clearness. We know with some certainty, thanks to the unselfish and stupendous exertions of such men as Beddoe, Collingnon, Ranke, Livi, and a host of their fellows in Europe whose work we have been outlining, what is the raw material of which our heterogeneous American population is to be composed. They have analyzed the sources of the great human stream which is flowing continually westward to our shores. They have acquainted us with the physical character of the communities whence come those who, as immigrants, cast in their lot with America for good or ill. It behooves us at once to know whether we are drawing off the scum, the lees, or the pure waters in this inflowing tide. Then, again, we have to determine the effects of this novel life—its climate, its social conditions, its material prosperity, and, above all, its ceaseless intermingling of all strains and classes—upon the physical constitution of the original ethnic stocks. Such are the problems which confront us. May we take up the scientific burden where our European *confrères* must of necessity lay it down; and, in the same devotion to knowledge for its own pure sake, bear it a step further along the way!

THE GREAT SIERRA NEVADA FAULT SCARP.

BY HAROLD W. FAIRBANKS, PH. D.

THAT portion of California lying east of the crest of the Sierra Nevada Mountains has had a remarkable geological history. There are many phenomena to be witnessed in that region which possess much interest aside from their purely scientific aspect, and deserve to be better known than they are at present. The enormous scale on which faulting has taken place, resulting in the precipitous eastern wall of the Sierra Nevadas, and the variety and extent of the comparatively recent volcanic outbursts along the lines of fracture, bring the magnitude of geological processes vividly before our eyes. There are probably no better examples of topographic features due to the elevation and depression of great blocks of the earth's crust, through the formation of faults, to be found in any other portion of the world. From a scenic standpoint, also, the region is unique. The lofty, jagged crest of the Sierras rises over fourteen thousand feet, culminating in Mount Whitney, the highest peak in the United States south of Alaska, while in marked contrast to the ice and snow of these mountain heights are the hot and scorching wastes of Death Valley, which lies but a short distance to the east, depressed over three hundred feet below the level of the sea. Snow-clad mountain and desert sand, mighty earth blocks, volcanic craters, lava flows, and alkaline lakes—where can be found greater attractions for the student of Nature?

The Sierra Nevada Mountains, having a length of over three hundred miles and a width of seventy-five miles, consist essentially throughout much of their extent of one great block of the earth's crust, having been elevated along a north-and-south line through a series of movements which have been frequently repeated during a long period of geological time. The block as a whole was not elevated, but tilted from the east, so that on that side there is an abrupt wall many thousands of feet in height, while on the west the slope is long and gradual. Owing to this fact it is only when seen from some point at its eastern base that the magnitude of this range of mountains is appreciated. Although the valleys at the eastern foot of the mountains vary from three thousand to six thousand feet in altitude, the wall of rock forming the scarp rises so abruptly and with such colossal proportions that it is absolutely overpowering in its grandeur. To the east and running parallel with the Sierra Nevadas are other giant ranges formed in much the same manner, being only slightly lower but separated from each other by desert valleys.

The mighty eastern scarp in all its distinctness might be considered as beginning on the south in the vicinity of Walker's Pass. With a gentle curve it sweeps toward the north, rising higher and



MOUNT WHITNEY, FROM LONE PINE CAÑON.

higher for a hundred miles, until culminating in the jagged peaks northwest of Owen's Lake, where Mount Whitney reaches an altitude of fifteen thousand six hundred feet above the level of the sea. From this point there is only a slight descent for a hundred miles more, beyond which toward Lake Tahoe its extreme height and ruggedness are lost, the single fault line being replaced by several whose displacements are less. The scenic effect is grandest from Owen's Valley, where the mountain wall bounding it on the west, even and regular in its general outline save for the deep transverse gorges, rises eight thousand to ten thousand feet above the valley. Viewed from the Inyo Range opposite, the evenness of the crest is remarkable. The great peaks are not isolated, as is Mount Shasta, so that their individual grandeur is lost in the general effect. Owen's Valley has a length of about a hundred miles and a width of six to twelve miles, with an even sand floor much of the distance. On the edges the floor gradually slopes upward through the *débris* fans covered with sagebrush to the bordering mountains. The scenery of this valley is not alone due to the Sierra Nevadas, for on its eastern side, running parallel with the former mountains, is another range known at its southern end as the Inyo Range, and toward the north as the White Mountains. These, if less elevated and rugged, never-

theless possess remarkable proportions, rising five thousand to eight thousand feet above the valley and terminating in White Mountain peak, with an altitude of more than thirteen thousand feet. It will thus be seen that Owen's Valley occupies a troughlike depression between two parallel earth ridges or fault blocks. It also divides the arid from the non-arid regions. The crests of the two ranges are but eighteen miles apart, with this depression nearly two miles deep between them. The western wall is white with snow much of the year, and from its rugged cañons issue numerous streams utilized for irrigating the valley; the eastern range, on the contrary, is comparatively barren, snow lies on it but a short time, and running streams reaching the valley are rare. Owen's Lake lies toward the south at the lower end of the valley. Its greatest diameter is about eighteen miles, but it has no outlet and is quite shallow. It is probable that at one time its waters emptied southward through the continuation of this fault valley into the great wastes of the Salt Wells Desert. The water of the lake is impregnated with sodium



SIERRA NEVADA FROM THE LONE PINE HILLS.

chloride, sodium carbonates, and sulphates. The soda is present in such large amount that it is obtained in commercial quantities. When the water is evaporated in shallow ponds or tanks the carbonates of soda crystallize out first, and are thus easily separated

from the other ingredients. The lake is fed chiefly by Owen's River, but at the present time it is slowly sinking. Whether this is due to growing aridity of the climate or because so much water is taken from the streams for irrigation is not known.

As we go north from the upper end of Owen's Valley a vast table-land of lava and volcanic ash is encountered, extending to Mono Lake. On the extreme head of Owen's River the volcanic material rises to the summit of the Sierras, almost obliterating the fault scarp for a number of miles.

Mono Lake is nearly circular, with a diameter of twelve miles. It has an elevation of a little more than six thousand feet, being about two thousand feet higher than Owen's Lake, and like the latter extends up to the very base of the fault cliffs forming the eastern wall of the mountains. The water is intensely alkaline, quite closely resembling in composition that of Owen's Lake. It is situated in a depression in the sandy desert, being surrounded by sand and volcanic rocks on all sides except the west, where rise the snowy peaks of the Sierra Nevadas to an elevation of more than thirteen thousand feet. Although the mountains at this point are still very imposing, their grandeur does not compare with those farther south in Owen's Valley. As we continue northward toward Lake Tahoe it appears that there are two or more fault lines to be made out, the lake itself, according to geologists, occupying a depression caused by the sinking of one of these blocks.

The geological history of much of the region along this series of mighty fault fissures which have resulted in the formation of the Sierra Nevada Mountains is as yet not thoroughly known. The glacial history of Mono Lake and the adjoining portion of the Sierras has been studied by Russell, and is better known than that farther south. It has been thought by Mr. Lindgren, of the United States Geological Survey, that, following the period of volcanic activity near the close of the Jurassic which finally culminated in the formation of enormous fused granite magmas, the portion of the crust embracing the Sierra Nevadas and the Great Basin became arched upward. As the result of this, a strain was set up which finally gave rise to north-and-south fault lines, and the region east of that now occupied by the Sierra Nevadas began to settle. This is supposed to have been inaugurated during the Cretaceous, and has continued at various times and in different amounts down to the present time. Toward the close of the Tertiary the displacement of the Sierra Nevada fault block was markedly increased, giving the range approximately its present outlines. There are many indications that an equilibrium has not yet been reached, as shown by the slip which took place at the time of the earthquake

of 1872. West of Mono Lake the total displacement can not be less than six thousand feet, while farther south in Owen's Valley it must have reached eight thousand to ten thousand feet, if not more.

Following the first faulting in the Cretaceous outlining the region occupied by the Sierra Nevada Mountains, the erosive agencies began to work actively, for the area was undoubtedly high and rugged. In the course of time the mountains were worn down in places to an approximately base-leveled condition, and erosion almost ceased. As a result of the renewed elevation in the latter part of the



GLACIAL ROUNDED BOWLDER, HEAD OF OWEN'S RIVER.

Tertiary, rapid erosion was again inaugurated and the present deep cañons were excavated. While these cañons on both slopes are exceedingly rugged, those on the east are very short, owing to the fact that the crest of the range almost overlooks the fault scarp. Those crossing this scarp have cut down nearly or quite to the level of the upper part of the *débris* fan which has grown up at their mouths. They are three thousand to five thousand feet deep, terminating upward in cirquelike amphitheaters of precipitous rock. Through the more rugged portion of the range the mountain peaks have in many instances flattened, plateaulike summits which present a

marked contrast with the steep walled cañons. This kind of topography is to be observed from a point south of Mount Whitney for more than a hundred and fifty miles northward past Mono Lake, and is undoubtedly the remnant of an old base-leveled condition reached during the early Tertiary and preceding the last important uplift. Mount Whitney even has an almost level summit, breaking away into vertical cliffs, which on its eastern side are over three thousand feet high, and form a portion of the cirque at the head of Lone Pine Creek. The plateaulike character is plainly discernible about Mono Lake, where it has been described by Russell.

At the mouth of each of the cañons debouching upon the desert there is a *débris* cone or fan of remarkable proportions. These fans have been formed by the radial distribution of the *débris* over the valley bottom below the mouths of the gorges whence the streams issue. The material of which they are formed consists of gravel and boulders, and has been spread out over many square miles of the valleys. They are among the most striking features of the desert. The long, even slopes, sometimes reaching six to eight miles into the desert, terminate abruptly against the rocky walls of the mountains. To one not familiar with the desert they do not seem of such immense size, but if a climb is attempted this illusion is soon dispelled, for the slope is long and rough, covered with boulders and intersected with dry water courses. Lone Pine Creek, heading under the great precipices of Mount Whitney, has many of these huge boulders strewn along its course. By some their position might be attributed to glacial action, but in reality this is not the cause. Six miles below the mouth of the cañon there are some ten to twelve feet in diameter, while at various points one to three miles below occur others reaching a diameter of twenty to twenty-five feet. The swiftly flowing streams, at times augmented to torrents by sudden cloud-bursts upon the mountains, are enabled to do an almost incredible amount of work in transporting material.

At the close of the Miocene began the volcanic disturbances which modified so much of the old topography of the northern portion of the Sierra Nevadas. These flows were chiefly andesite with some rhyolite, and issued from fissures along the lines of faulting. The solid flows, breccias, conglomerates, and ash built up great ridges and mountains at many points. Between Lake Tahoe and Mono Lake much of the older surface was buried. From the latter lake southward for seventy-five miles there is a vast barren tableland, while between the North Fork of Owen's River and the San Joaquin the volcanic rocks reach up to and even form the crest of the Sierras for a number of miles. The volcanic eruptions continued through the Pliocene, and at its close occurred another eleva-

tion of the Sierras, making more marked still the great fault on its eastern side and differentiating it more completely from the region to the east. From the Mohave Desert northward, the whole length of the Sierras, these lines of weakness have given rise to an almost continuous line of volcanic craters and flows.

The Glacial period in the Sierra Nevadas was finally ushered in, being doubtless due to the increased elevation in this enormous fault block. Whether this period was contemporaneous with glaciation



GLACIAL LAKE, HEAD OF OWEN'S RIVER.

in the East is not known. There are many things, however, which lead us to believe that it was more recent here. Glaciers still exist in the shadows of the higher peaks, and the facts that their scourings are so fresh and the moraines so slightly modified are strong evidences in favor of the view that the ice period terminated very recently. The glacial phenomena about Mono Lake have been studied by Le Conte and Russell, but farther south they remain still almost unknown. Owen's River heads in the Sierras about forty miles south of Mono Lake. It is a stream of considerable size, draining a large basin, and issues from its rocky gorge at an elevation of eight thousand feet, thence flowing for many miles across the elevated volcanic table-land. Because of the elevation the immense glacier, which once gathered its strength in the basins of the fifteen

beautiful lakes that now exist there, flowed far out upon the volcanic mesa at the foot of the scarp, which here has very nearly obliterated the latter feature. The moraines are apparent for a number of miles, but just how far they extend has not yet been determined. This ice stream was probably the largest of any which issued from the mountains, a fact due in great part to the elevation of the mouth of the cañon. Lakes fill all the depression in the bed of this ancient glacier, illustrating how much the present scenic features of the Sierras are due to ice action. As we go south from the head of Owen's River into the valley of the same name it is apparent that only at its northern end did the glaciers reach as low as the



GLACIAL MORAINES, HEAD OF OWEN'S RIVER.

mouths of the cañons and flow out upon the *débris* cone. Opposite the highest and most rugged portion of the Sierras in the lower part of Owen's Valley, it is evident that the temperature was too high to permit the glaciers to reach an elevation as low as the valley floor. The size and symmetry of many of the moraines reaching into the valleys in the region of Mono Lake strike the attention at once. The Green Creek glacier in particular left morainal walls of great size and regularity. At the mouth of the cañon the flat valley is about half a mile wide, with steep and even walls of boulders and gravel rising three hundred to four hundred feet.

Many of the lakes are due to the presence of the terminal moraines, while others fill rock basins.

Russell has described the terraces or gigantic stone steps by which many of the cañons rise, and the deep-walled cirques at their heads. About Mount Whitney these features are illustrated on a grand scale. The vast rocky amphitheaters at the heads of the cañons are bounded by precipitous walls one thousand to two thousand feet high, while their bottoms are generally occupied by lakes in basins of solid rock.

Lake Mono is at present gradually rising, thus differing from Owen's Lake. The history of these sheets of water has been a checkered one. Periods of high water have alternated with those of desiccation. The last high-water stage seems to have been contemporaneous with the glaciation. Well-defined terraces appear about Mono Lake, indicating the various stages of the water. In this region the opportunities for the study of the glacial phenomena are excellent, for only a small part of it has as yet been investigated.

What is perhaps of more interest than the glaciers is the recent volcanic action so remarkably exemplified about Mono Lake. Following the andesitic flows which took place near the close of the Miocene and in the early Pliocene, there were numerous eruptions of basalt, although some of the basalts of this region may be considerably older. South of Owen's Lake the basalt flows are numerous and extensive, volcanic action in that region being most strongly marked in the Coso Mountains. The most recent eruptions of all have, however, taken place in the vicinity of Mono Lake. Here the surface of the flows is often so fresh and free from soil that it seems as if they had but just cooled. From the lake southward for twenty miles there is a line of volcanic cones known as the Mono craters, which are connected with the most recent eruptions and possess great interest. The cones have been built up on extensive obsidian flows, the whole forming a considerable mountainous elevation. The glassy eruptions came first, then the cones were built up of lapilli and scoriaceous material, while the volcanic ash which covers the country for miles around was probably the last to be thrown out. These recent glassy lavas were very viscid and cooled in thick masses instead of thin sheets. This is finely shown in the southernmost of the eruptions, where the glistening, glassy mass which broke into fragments as it cooled rises in almost precipitous crags fifty to seventy-five feet. The bottom of the valley between two different *coulees* is occupied by a small stream which runs over an older lava. From the surface of the latter, which is covered with soil, spring immense pine trees which must have sprouted since the glass cooled, for no vegetation could have withstood the heat. A

climb over the sharply angular fragments which form the wonderfully rugged surface of the obsidian flow is an interesting experience. Great jagged points project up here and there from the broken surface, while the total lack of soil and the bright, clean surface of the brecciated glass makes it appear as though it were but yesterday when the seething mass welled up, overspread the surface, and cooled. Several circular depressions in the valley adjacent to the lava attract the attention. They appear like craters, but it is clear



DÉBRIS SLOPE AT FOOT OF SIERRA NEVADA FAULT SCARP NEAR OWEN'S LAKE.

that no lava ever flowed from them, and they were probably formed by some explosive action from beneath. The greatest body of ash, lapilli, and obsidian flows lies immediately south of the lake and constitutes the Mono craters. They present a weird appearance, rising in their nakedness from the sandy sagebrush plains with the dark background of pines to the south. The Mono craters can not be more than a few hundred years old. They certainly date from post-glacial times.

The two islands in Mono Lake are possessed of great interest, and are well worthy of a careful examination. They are largely volcanic, and present some exceptional geological features. The larger, known as Pa-o-ha, is about two miles long, and consists in part of stratified lake deposits raised up by some convulsion, while

the smaller, known as Negit, or Black Island, is wholly of volcanic origin. The lake beds on the larger island are faulted and generally much disturbed, but are probably not older than the Quaternary. The eastern and northern parts consist of a black basaltic lava, very fine-grained or even glassy. Much of it is younger than the sedimentary beds. The lava extends beneath the water on the northern side of the island in such a manner as to indicate that it flowed out during a stage of low water. At the southeast side hot springs issue from the lava just beneath the surface of the water. The bare rocks above are seamed and decomposed, and from holes and crevices there issue jets of steam which are visible for long distances in the cold weather. At the eastern end there are several peculiar craterlike depressions in the lava. One or two of them lie partly beneath the surface of the lake, and are being destroyed by the action of the waves. Several are, however, very perfect and symmetrical, about fifty feet deep, and as they extend beneath the lake level their bottoms are filled with water. No melted rock ever appears to have come from them, and there are several reasons for concluding that their origin is due to the same causes as those on the head of the North Fork of Owen's River already mentioned. This was the explosive action of gases beneath, completely shattering the massive lava and blowing out the material once occupying the depressions. It does not appear that any of this material could have been fused, for the fragments scattered around over the surrounding surface are all angular. Volcanic ash is strewn about and may have followed the explosions. A similar craterlike depression occurs in the sedimentary beds on the southern side of the island, and it can only be accounted for by a similar cause, or possibly by the falling out of the bottom.

Negit Island presents from a distance a dark, forbidding aspect. It is long and low, with a broad, truncated cone at its western end. A close examination shows this cone to be a mass of different colored lavas and scoria fissured and thrown into all kinds of shapes by earthquake movements. It is so shattered that it seems ready to crumble away and sink in the lake. The whole island has the appearance of having been elevated from beneath the water in very recent times, and shattered to its very center. On the eastern side the massive flows have evidently been lifted upward in such a manner as to leave great open fissures four to six feet wide and descending to unknown depths. From the level of the lake they are filled with water. These islands possess a most unique character, and, taken in connection with the Mono craters with their flows of acid lavas, illustrate volcanic phenomena more strikingly than almost anything else in the United States. The fact that the volcanic action has been so recent adds

greatly to its interest. The oldest lavas in the region seem to have been rhyolites and andesites, then followed basic andesites and basalts, and last of all the acid and glassy rhyolites of the Mono craters.

On the north side of the lake the tufas, built up by springs issuing from beneath the water, form a most interesting study. Great masses of calcareous material have been formed about the orifices



OBSIDIAN FLOW SOUTH OF MONO LAKE.

of these mineral springs, assuming odd and striking shapes. In the desiccated lakes of the desert in southern Inyo County these calcareous tufa deposits stand out in all their proportions.

It is probable that the forces producing the recent volcanic action are but slumbering, and that in the future, as in the past, movements will continue to take place along this great fault line bounding the Sierra Nevadas on the east. When the strain becomes too great, earthquakes will be felt and possibly followed by eruptions of lava.

The most severe earthquake of which we have any record on the Pacific coast of the United States was due to movement along this fault. On March 26, 1872, nearly the whole of California and Nevada was violently shaken. The loss of life was, however, confined to Owen's Valley. At Lone Pine, near the foot of the valley,

out of a population of about three hundred people, twenty-three were killed and sixty injured. Goodyear has described in detail the effect of this earthquake. After the event an examination showed numerous fault lines, extending as a general thing parallel to the base of the Sierras. Local areas sank, and in addition to the vertical movement there was a horizontal one amounting in some instances to from twelve to eighteen feet. Owing to the slight rainfall, the fault scarps left by this earthquake may still be seen. They indicate either a depression of the valley or an elevation of the Sierras to the extent of several feet. Russell mentions a fault cliff near Mono Lake of fifty feet which he thinks may date from this disturbance. It is clear that an equilibrium has not yet been reached, and there is no telling when the shocks may be repeated. These things forcibly remind us that geological processes are going on to-day as in the past. The common phenomena around us teach the same thing, but we become so used to them that they are not noticed, and it is only when our attention is called to some great example, something out of the ordinary, that we realize the transitoriness of even the great mountains.

I have thus tried to trace in a general way the history of the fault fissures and the great mountains and deep valleys produced by them along eastern California from their inception in the Cretaceous down to the present. Many of the geological phenomena connected with this subject are without doubt displayed on a grander and more imposing scale in this region than anywhere else in the United States.

It is related in William Vogt's *Vie d'un Homme* (Carl Vogt) that one evening Vogt, Helmholtz, and Kopp were talking about fish culture with the proprietor of an inn near Heidelberg. The innkeeper, who practiced in the art, expressed his contempt of all the books that pretended to treat of it—saying that the whole lot was not worth a mug of stale beer. Some were obscure, others wrong, and others incomplete; and one could see in an instant that they were all written by closet naturalists who had never one of them caught a gudgeon. Helmholtz and Kopp enjoyed his remarks greatly as a joke at the expense of Vogt, who had written a book on the subject, and laughed at their comrade. The innkeeper was gratified at the signs of approval of what he had said, and continued: "Now I think of it, gentlemen, I must make one exception. I have a book published by Brockhaus at Leipsic, with pictures in the text, that is worth more than all the rest together. It is written by a man who knows all about the subject, who we perceive at once has seen with his own eyes and tried his methods himself. I will show it to you." The man withdrew and returned with the volume. "Here it is! it has just been published. It is called *Die künstliche Fischzucht*" (Artificial Fish Culture), "by Prof. Carl Vogt, professor in Geneva!" It was Vogt's turn to laugh.

PHYSICAL TRAINING IN THE COLLEGES.*

BY FRED E. LEONARD, M. D.,

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IT is a conspicuous fact that within the last two decades of the present century our foremost colleges and universities, with few exceptions, have been providing for the physical training of their students by the erection of gymnasia which in many instances rival the other buildings on the campus in size and cost, and by assigning the direction of the work done in them to some officer supposed to possess special qualifications for his position. In such recently founded institutions as Leland Stanford and Chicago Universities, the chair of physical training has been among the first to be filled, and the gymnasium has followed close upon the library.

The wisdom of this new departure in college education is apparent. Many a student is physically defective when he enters upon the course of study. The general muscular development of thirteen out of the last one hundred men examined at Oberlin was noticeably poor, eighteen were flat-chested, more than a third stood with head and shoulders drooping forward and abdomen protruding, an equal number were flat-footed, and nearly as many carried one shoulder considerably lower than the other. Deficient mobility of the chest walls, irregularities in the heart's action after exertion, nutritive disorders, abnormal susceptibility to colds, evidences of exaggerated nervous irritability and of faulty muscular control are frequently observed.

The conditions of college life, too, favor physical carelessness. The current sets strongly in the direction of mental effort. The scholar's ambition is aroused, his circle of interests widens, he realizes the need and the possibilities of intellectual attainment. Under the urging of teachers the successful student is likely to apply himself too continuously to his books; the poor student, or the one who is unused to study, may be compelled to exert himself to the utmost in order to keep up with his mates. Social distractions make their demands upon spare moments, and outside interests multiply as the end of the course approaches. The claims of the body for a reasonable share of care and training are easily overlooked, unless there is some organized attempt to enforce them.

It is during these very years of student life, moreover, that the growth period of the body comes to an end. This growing period is

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the impressionable one. The bones are being consolidated, the chest is taking on its final shape, respiratory and circulatory power can still be increased, the nervous system is wonderfully responsive to training, and the possibilities of attainment in muscular control are at their highest. Never again can correct habits of carriage and action be so easily established, and the human machine be brought so completely under the control of the will and made its ready servant.

Student athletics, although they form an important part of the necessary physical training, are not sufficient. So far as they go they are invaluable, drawing the student out of doors and away from the routine of school life, and affording exercise made vigorous by the stimulus of competition. They help to counteract influences that tend to overrefinement and effeminacy. They demand and develop presence of mind, alertness, physical courage, self-control. But even the size of the playgrounds which they require makes it impossible that they should reach all the students in any but a small institution. They attract the most proficient, not the most needy. They have their place in the fall and spring, but must be given up entirely, or only occasionally practiced, during the four or five months of the year when the temptation to physical inactivity is greatest. They leave untouched some of the commonest physical defects. They are largely lacking in careful supervision, system, gradation, adaptation to individual needs. They can be compared to the student's general reading, rather than to his serious study. In a word, though they yield the recreative and hygienic results of physical training, they are lacking in the corrective; they are educational, but only in a haphazard sort of way.

Amherst College, in 1860, was the first in America to establish upon a sound basis a department of physical training, placing at the head of it a thoroughly educated physician, a member of the college faculty, with the title of Professor of Hygiene and Physical Education. Dr. Hooker, the first incumbent of the chair, was succeeded a year later by Dr. Edward Hitchcock, whose period of service has been an unbroken one from that day to this. Nearly a score of years passed before Harvard College (1879) became second on the list, by appointing Dr. D. A. Sargent assistant professor of physical training and director of the Hemenway Gymnasium, which had been erected at a cost of more than a hundred thousand dollars. Within more recent years the same thoroughgoing provision has been made by Bowdoin, Cornell, Oberlin, the Universities of Pennsylvania, Michigan, and Wisconsin, Leland Stanford University, and a number of smaller institutions. Yale has two associate directors of the gymnasium who are physicians, but they are not given entire charge of the department. At Brown and the University of Chicago the de-

partment is well organized, but is not under medical direction. Few of the other colleges of recognized standing are without a director of the gymnasium, but too often they have been content with the erection of a showy building, instead of looking to the organization of an efficient department; it has not been put upon an equal footing with other departments of instruction and expected to do the same quality of work; the same grade of general culture and special preparation has not been exacted from its head.

Of the colleges for women, Smith, Vassar, Wellesley, Bryn Mawr, and Mount Holyoke all have college physicians, in most cases giving instruction in physiology or hygiene, or both. Each has in addition a director of the gymnasium, but only at Bryn Mawr is she a medical graduate. None of these directors is given the rank of professor in the faculty, but they are better qualified for their positions than are many of the male directors. The Woman's College of Baltimore is the best organized, with a professor of anatomy, physiology, hygiene, and physical training, and two instructors in physical training.

The completion of the Hemenway Gymnasium at Cambridge, Massachusetts, in 1879, marked the beginning of the present era of gymnasium building in American colleges and universities. The example of Harvard was followed during the next decade by Amherst, Cornell, Johns Hopkins, Bowdoin, Williams, Lehigh, Bryn Mawr, Vassar, and some others; and among the large number added to the list since 1890 are Yale, Wesleyan, Brown, Rutgers, Colgate, the Universities of Michigan, Wisconsin, and Chicago, Leland Stanford, Smith College, and the Woman's College of Baltimore. The cost of the better class of these buildings ranges from ten thousand dollars to two hundred and fifty thousand dollars, the average being not far from fifty thousand dollars.

A typical gymnasium of the period may be described somewhat as follows: It is built of brick or stone, several stories high, with a basement. The large main hall, containing the bulk of the apparatus, is open to the roof, unobstructed by posts or pillars, surrounded by a suspended gallery for the running track, and crossed above by iron beams to which the swinging apparatus is attached. On the floor below, or in the basement, are lockers in which the clothing worn during exercise is stored between times. Here, too, is a very important feature, the bathing equipment, consisting commonly of a plunge bath, tubs, and a considerable number of shower and spray baths. There are also the director's office and examining rooms, rooms for special developing appliances, or for boxing, wrestling, and fencing, perhaps bowling alleys in the basement, a "cage" for indoor baseball or tennis, an athletic trophy room, and others for the use of

janitors, for the heating and ventilating plants, fuel, etc. The whole building is heated by hot water or steam. The apparatus in the main hall is partly portable, including wooden and iron dumbbells, Indian clubs, and wands; there are pulley weights, arranged to exercise all the principal groups of muscles, and adjustable to suit all grades of strength; fixed or "heavy" apparatus, comprising such forms as the horizontal bar, parallel bars, ladders, ropes, poles, swinging rings, the horse and buck for vaulting; and provision is also made for a variety of simple throwing and running games.

Before the student enters the gymnasium he is generally called upon to submit to a physical examination. In some schools this is required of every student, whether he goes to the gymnasium or not; in others it is optional for all, or confined to those in actual attendance. Its extent and thoroughness vary with the training and character of the examiner and the time at his disposal; but there is a general uniformity of method throughout the country. The most complete form includes (1) a record of certain facts of family and personal history which may explain abnormal conditions, if these are present, and direct attention to probable tendencies. Among such facts are the nationality and longevity of grandparents and parents, the environment and health of parents, the father's occupation, diseases common in the family or thought to be hereditary, personal injuries and diseases, habits regarding physical and mental work and recreation, sleep, life in the open air, the use of stimulants and narcotics; (2) a systematic inspection of the whole body, recording such points as apparent temperament, general muscular development and condition, the position of head and shoulders, deviations from the normal curvature of the spinal column, shape and mobility of the chest, proportionate development of various groups of muscles, and abnormalities of whatever sort; (3) a medical examination of the heart and lungs; (4) a series of about fifty measurements of weight, height, various lengths, breadths, and depths, the girths of trunk and limbs at different levels, followed by tests of lung capacity, and of the strength of large muscular masses—for example those of the chest, back, front of thighs, upper arms, and forearms.

In many instances, and especially where the director is without medical training, the examination is much less complete, and covers little more than a few facts of history and a series of measurements and tests. These may be of value as a means of interesting the student in his own development and furnishing data for future comparison, but by themselves they are almost worthless as an index of physical health and proficiency, or as a ground for special instructions. They need to be supplemented and explained by inspection, and by other means of examination and diagnosis. But if the work

has been thoroughly done, the director has at hand a valuable fund of information to be used in framing advice suited to the needs of the individual, and the study of hundreds of such cases together may yield important deductions concerning the characteristics of the student class. In this way a variety of graphic charts have been prepared, upon which the measurements and tests of the individual can be plotted, so as to show at a glance his relation to an imaginary standard. It is true, however, that much of the chart-making hitherto done has been of trifling scientific value, based upon insufficient data, or the result of superficial methods. This study of men in masses should not lead to the neglect of the individual, who, after all, must be compared with *himself*, with his own latent possibilities.

There is so much diversity in the methods of physical training employed in our colleges and universities at present that a satisfactory summary is difficult to give. As elsewhere in this paper, where names of institutions are used by way of illustration no attempt is made to furnish complete lists. A few schools, like Bowdoin and Leland Stanford, allow credit for work done in the gymnasium, just as for any course in the laboratory or classroom. Regular attendance during the four years of undergraduate life is required at Amherst, Bowdoin, Brown, University of Chicago, Bryn Mawr, Smith, Vassar, and the Woman's College of Baltimore. The requirement extends only through the junior year at Mount Holyoke and the women's department at Oberlin; through the sophomore year at Wesleyan and the University of Wisconsin; and is confined to the freshman year at Cornell, Dartmouth, Williams, and Wellesley. Attendance is altogether optional at Harvard, Yale, Princeton, Johns Hopkins, and the Universities of Pennsylvania and Michigan.

The nature of the work done can be shown with tolerable accuracy by the selection of certain types. The results sought at Amherst are hygienic and recreative, rather than corrective or educational. The men meet by college classes, each of which elects its captain. The characteristic feature is a memorized series of exercises with wooden dumb-bells, set to music and executed by the entire class under the leadership of its captain. The men are required to be present and to take part, but beyond this there is little attempt at discipline. They have a good time, all the functions of the body are stimulated by the vigorous exercise, and the spirit of class rivalry, intensified by a system of prize exhibitions, insures a degree of proficiency. The use of the fixed apparatus is optional, and not much is made of prescription work for the individual. This plan, while it has given general satisfaction at Amherst for many years, has not been introduced into other schools to any extent. It owes much of its success to the peculiar conditions existing there, and to the per-

sonality of the beloved director, Dr. Hitchcock. Some of the features have been adopted at Cornell, where, however, the work has to be combined with a system of military drill.

The conditions at Harvard are quite different. The number to be provided for runs up into the thousands. The system of electives abolishes class lines, and forbids an arrangement of the schedule which would leave certain hours free for exercise. It therefore becomes next to impossible to group the men for graded instruction, and prescribed work for the individual has been adopted as offering the best solution of the problem. Dr. Sargent's series of widely known and used pulley weights, adapted to a wide range of wants and strengths, was devised to render more efficient the making and carrying out of these prescriptions. While such a plan is admirably suited to the needs of Harvard, it has been a mistake to introduce it so extensively into schools where the age of the pupils renders more constant supervision and direction desirable, and where instruction can be given in graded classes, with the added incentive that comes from working in company with others. The use of the so-called developing appliances secures results which are corrective, and in a measure hygienic, but they lack recreative and educational qualities.

What has been said of Harvard will apply in the main to Yale, though there the interest in athletics overshadows all else. At Bowdoin a system of applied athletics, or competitive gymnastics, is the distinguishing feature. The freshmen, in addition to their prescribed corrective exercises, are given a preparatory discipline in military tactics and Indian-club swinging. The sophomores receive class instruction in the elements of boxing and wrestling, with supplementary squad work on the fixed apparatus (horizontal bar, parallel bars, flying rings, etc.), the squads being arranged in three groups graded according to strength and skill. The juniors learn to fence with single-stick and broadsword, and the seniors with foil and mask. The results sought are clearly educational, as well as corrective and hygienic. The work at Brown, though it differs in details, can be referred to the same type, except that military drill is required in the fall and spring of the freshman and sophomore years, under an officer in the United States army.

Where the work is required only during the early part of the course, or for a term or two, it is in too many instances unworthy to be called scientific or pedagogic. It is usually a combination of prescribed exercises for the individual and memorized class drills with light apparatus, together with optional use of the fixed apparatus. It has, to be sure, some corrective and hygienic value while it lasts, but is likely to grow monotonous, and is dropped before it has accomplished much in the way of genuine training. It can not

be too strongly insisted that proper grading of classes, careful selection and arrangement of teaching material, progression in each lesson and throughout the series of lessons, and skillful adaptation of methods to meet local conditions, are of fundamental importance in physical training, as they are in other phases of educational effort.

Some surprise may be excited by the statement that at the present time the most painstaking and satisfactory work is being done in the colleges for women, but it is probably true. The college officers are as a rule more alive to the importance of the department, the teachers are with few if any exceptions graduates of normal schools of gymnastics which require two years of study, and the disturbing element of athletics does not enter so largely into competition with efforts at systematic physical training. At the Woman's College of Baltimore the system employed is purely Swedish, and the instruction is given by two graduates of the Royal Normal School of Gymnastics in Stockholm. The same system is employed, though less inflexibly, at Smith College. Bryn Mawr and Vassar have a combination of individual work and class instruction with light apparatus, making most of the former. The work at Mount Holyoke is somewhat the same, but more varied. At Wellesley athletics receive a relatively larger share of attention.

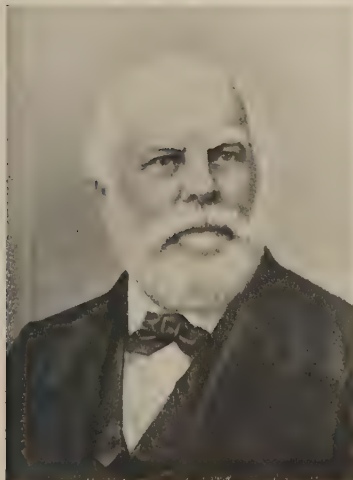
It will not be out of place to refer, in conclusion, to a source of instruction and suggestion almost unknown to the great majority of the directors of American college gymnasia. We in this country have been greatly benefited by the study of Swedish gymnastics; but any one who comprehends the wealth of the German literature of gymnastics, and the extent and variety of the experience of which it is the outcome, must regret the fact that it has been hitherto so generally overlooked. It offers an inexhaustible storehouse of material which will be found especially helpful in planning courses in physical training for advanced classes in our institutions for higher education.

MATTHEW ARNOLD, though best known as a literary man, did equally valuable work in education, with which he was closely connected for a long series of years as inspector; and Sir Joshua Fitch, in his biography of him, credits him with having exerted a real and telling influence on schools and done much indirectly to raise the aims and the tone of teachers; and, the biographer says, "if he saw little children looking good and happy, and under the care of a sympathetic teacher, he would give a favorable report, without inquiring too closely into the percentage of scholars who could pass the examination. He valued the elementary schools rather as centers of civilization and refining influence than as places for enabling the maximum of children to spell and write, and to do a given number of sums without a mistake."

THE ACADEMY OF NATURAL SCIENCE OF ST. LOUIS.

BY PROF. FREDERICK STARR.

IN 1837 St. Louis was scarcely more than a small frontier town, yet in that year there was organized, through the efforts of two young men of foreign birth, what was perhaps the first society for scientific research established west of the Alleghany Mountains. The prime movers were George Engelmann and Frederick Adolphus Wislizenus. The new society was called the Western Academy of Science. It was progressive and enterprising, and even as early as



DR. GEORGE ENGELMANN.



B. F. SHUMARD.

1840 made an effort to establish a botanical garden at St. Louis—an effort that failed. Interruptions and discouragement came, and finally the pioneer society ceased to exist.

It was nearly twenty years later that the Academy of Science of St. Louis was born. Organization must have taken place and some things must have been done in 1856. In the list of organizers were the two names of Engelmann and Wislizenus. In January, 1857, the academy was incorporated. The list of incorporators reads: "George Engelmann, Hiram A. Prout, Nathaniel Holmes, Benjamin F. Shumard, Charles W. Stevens, James B. Eads, Moses M. Pallen, Adolphus Wislizenus, Charles A. Pope, Charles P. Chouteau, William F. McPheeters, and others."

The organization of the society, as shown by its standing committees, was sufficiently detailed and heavy to kill a modern society.

There were standing committees in the following subjects: Ethnology, comparative anatomy, mammalogy, ornithology, herpetology and ichthyology, chemistry, geology and malacology, entomology, botany, paleontology and geology, mineralogy, chemistry, physics, embryology, and monstrosities. But the academy was incorporated to last, and it survived.

There had been preliminary meetings, but the first regular meeting was held March 10, 1856, in the hall of the Board of Public Schools. George Engelmann was elected president and Benjamin F. Shumard secretary. At the second meeting active work was begun. At that meeting the well-known name of Dr. Koch first appears. He then presented to the museum a plate of Koch's *Missourium*. The *Missourium* (truly *Mastodon giganteus*) played a lively part at one time in geological and archæological discussions in this country. Dr. Koch at this meeting offered to visit Mississippi for the academy, and investigate certain finds recently made of the remains of *Zeuglodon*—a gigantic fossil whale. This was probably the first investigation made at the expense of the new academy. Dr.

Koch visited Mississippi, made his investigations, and collected a lot of fossils from Tertiary and Cretaceous formations.

Among the original members was Mr. Charles P. Chouteau, one of two out of that list of incorporators who still lives. Mr. Chouteau, a man of business and means, never permitted his intelligent interest in the academy and its work to flag. Connected with the fur trade, his business



CHARLES P. CHOUTEAU.

took him or his representatives on frequent journeys into the far West. Such expeditions were enormous enterprises in those days. At that time even journeys to the East were no trifles. Mr. Chouteau—after recently making the trip from St. Louis to New York in twenty-four hours—narrates that on one occasion, when a young man, he was sent to New York to see Mr. Astor on im-

portant business. He made the journey in three weeks, a time so short that his statement was deemed almost incredible in Mr. Astor's office. One can only imagine, then, how great was the undertaking of a journey up the Missouri, across the plains, and through the mountains. From the start it was the policy of the academy to cultivate a museum. At that same second meeting when Koch offered to go zeuglodon-hunting, Mr. Chouteau generously offered to place the Bad Lands collection of fossils collected by Dr. F. V. Hayden—for that time a large and important collection—in the academy museum, donating his one-fourth interest in it to the society. Not long after he showed his cordial interest by “desiring the academy to name some naturalist to accompany him on his expedition to the upper Missouri this summer free of expense to the society.” More than once afterward Mr. Chouteau took some naturalist or scientific man with him on similar expeditions into the far Northwest.

The old Western Academy of Science had done something toward securing property, and in 1856, at the meeting of August 4th, its library, collections, cases, and apparatus were transferred to the new society. A special meeting was held for receiving the transfer. Unfortunately, nothing of this donation remains to-day except the seal and the little book of old proceedings.

The academy was fortunate in having in its membership from the start men who were interested in science and able to conduct independent investigation. Shumard, Swallow, and Eads were professional scientists; Engelmann, Prout, and Wislizenus, while busy professional men, were original investigators in more than one field. From the very beginning of the society's history, the idea of work, rather than play or recreation, was present; not only was a museum to be gathered, but papers read at the meetings were to be printed. We find, accordingly, by the end of the third year of the academy's life, that two numbers of Volume I of their Transactions had been printed. These had been widely used in exchange, and more than one hundred and eighty societies in the United States, Canada, Mexico, Cuba, Chili, Asia, and Australia had entered into relations with the academy. The six volumes of the Transactions now in print are bulky tomes—the first containing 716 pages. That included many important papers. Geology naturally occupied a prominent place in a society where the Shumards, Swallow, and Prout were leading spirits, and in their publication many new species of fossils were described, and many papers regarding formations and the stratigraphical problems of Missouri, Kentucky, Kansas, and other Mississippi Valley and central States were presented. We have already stated that one quarter of the Hayden collection of Bad

Lands fossils had been given to the academy by Mr. Chouteau. About the middle of 1857 the academy bought the one fourth which belonged to Mr. Vaughan. While all these things indicated that the academy was particularly favored in its early years, it would be a great mistake to think that it found only easy sailing. While its ideas were broad and its membership active, while its papers were of scientific value and its proceedings were eagerly sought in exchange, the financial problem was serious. Thus Prout says, in 1862: "Surrounded by difficulties and embarrassments, without means and without patronage, we have struggled on and struggled successfully. We had hoped that, ere the present moment, some friend or friends of science with enlarged and liberal ideas would have extended to us a helping hand, and placed us in a condition to give the world a more ample exhibition of the fruits of our labors. But for the generous liberality of one of our members we should not now have a place to hold our meetings or to garner up the treasures which have been so liberally contributed to our museum; and, again, those objects lose part of their interest for the want of appropriate casing in which they could be scientifically arranged and classified." In fact, the mere publishing of the Transactions was a heavy burden; the fees were not adequate to the task, and private gifts were solicited to continue the work. It was war time, and St. Louis particularly felt the disastrous effect of the strife. Men were too busy with political affairs, too anxious regarding what a day might bring forth, to contribute much for the encouragement of science. Even these circumstances, however, had some compensations. An institution of learning—McDowell College—was changed into a war prison, Gratiot Street Prison. The military authorities transferred its collections to the academy, and we find the following resolutions in the minutes: "Resolved, that the thanks of the academy are due to Major-General Curtis, as also the members of the Western Sanitary Commission, for interest taken by them in the preservation of what remained of the McDowell Museum of Natural History when it fell under their control; and that Captain Curry, of the Tenth Missouri Cavalry, and the men under his command are entitled to our special acknowledgment for the zeal and fidelity with which the order of General Curtis for the removal of the collection to the halls of the academy was executed by them."

The first recognition of the academy, so far as we know, was by the Academy of Science of Philadelphia, which early—presumably before any publications had been made by the new organization—donated its Transactions and the second set of its journal. In 1866, when the St. Louis Academy had passed its first decade, we find her playing a similar magnanimous part to other institutions. At that

time the Portland (Maine) Society of Natural History had just met serious loss from fire. It was therefore resolved that the academy should donate to the unfortunate society a full set of its Transactions, together with minerals and other museum specimens. The Chicago Academy of Science having suffered in a similar way at the same time, a like courtesy was extended to it.

It will be remembered that the first meeting was held in the rooms of the Board of Public Schools. Nearly or quite all the following meetings for a long time were held at the local Medical College, in O'Fallon Hall, through the courtesy of Dr. Pope at first, and later through that of his successor, Dr. Hodgen. Twelve years of the life of the academy passed thus, when an effort was finally made to secure new rooms in the building of the Polytechnic. A committee was appointed September 2, 1868, in this matter; the negotiations went on for some months. The museum of the academy was by this time distinctly creditable. Mammals of the Rocky Mountains were the result of Mr. Chouteau's interest. A fine meteorite from Nebraska had been secured; sections cut from it had been exchanged for similar pieces from other localities, until thirteen meteoric falls were represented. The chief importance of the museum, however, was in paleontology; the Hayden collection has already been mentioned; there were also important local collections; among foreign matter was a particularly fine complete skeleton of the cave bear. Just at the time when the museum's prospects were so good, May, 1869, fire broke out in the Medical College building, and the whole museum was swept out of existence. The only valuable specimens left uninjured were a skull of *Bos cavifrons*, some mastodon vertebræ, and several meteoric specimens, including the original piece from Nebraska. Fortunately, the library was saved, and the greater part of the Transactions, though some of these were injured by water.

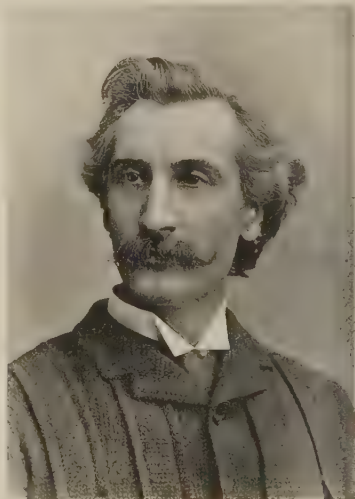
During this year, just before the fire, the president, Benjamin F. Shumard, died. He was born at Lancaster, Pennsylvania, November 24, 1820. His taste for science may have come to him from his mother's side; her father, a Mr. Getz, was an inventor and a maker of instruments of precision. When Benjamin was still young, his father removed to Cincinnati, and the boy was sent to Oxford for his college education. He returned to his native State to pursue his medical course, but had hardly well begun his work when his father removed to Louisville, Kentucky. The result was that the young man completed his studies in that city, graduating in 1846. His practice began in that State, first in the interior, later in Louisville. The young physician's leisure was devoted to the study of local paleontology and zoölogy. Making some reputation,

he was appointed by David Dale Owen to an assistant's position upon the Geological Survey of Iowa, Wisconsin, and Minnesota. In 1850 he was Dr. John Evans's assistant in a geological reconnoissance of Oregon, and spent the greater part of two years in the field. In 1852 he returned to Louisville to work out his report, and to assist his brother in preparing for publication the paleontological results of the Marcy Red River Expedition. In 1853 Dr. Shumard removed to St. Louis to serve as an assistant upon the State Geological Survey organized under Prof. G. C. Swallow. In 1856, appointed State Geologist of Texas, he made a study of the remarkably complete series of rocks occurring in the eastern and central part of that State. The war interfered with his work, which was never resumed. Returning to St. Louis, he died there, April 14, 1869.

Prof. George Clinton Swallow forms one of the striking features in the early history of American geology. On one occasion Prof. A. C. Ramsay, the eminent director of the Geological Survey of



G. C. SWALLOW.



PROF. CHARLES V. RILEY.

Great Britain, said: "I will say that the names of Dana and Hall, and Hitchcock and Rogers and Silliman and Swallow, and your other scientific men, are as familiar in our mouths as household words." Born on a farm, at Buckfield, Maine, in 1817, George C. Swallow had no great opportunity for education. With ambition and purpose, however, he pushed his way, and in 1843 graduated from Bowdoin College. His interest was chiefly in chemistry in its practical application to agriculture. Immediately on graduation

he was appointed lecturer in botany at Bowdoin, and gave the first courses in that subject at that institution. Shortly after, as principal of Hampden Academy, he had an opportunity long desired, and interested the State Legislature in experimental agriculture. The Legislature gave him a grant of land, and he at once organized a system of agricultural experimentation and a laboratory of agricultural chemistry. In 1850 he removed to Missouri, where he had been appointed to the chair of chemistry and geology in the State University. His influence in the State was at once felt. An address made by him, in 1852, led to the organization of the Agricultural and Mechanical Associations of Boone and St. Louis Counties. Such associations, for the benefit of farmers and interchange of ideas in agriculture, were then rapidly organized throughout the State. In 1853 Professor Swallow took charge of the State Geological Survey, which he conducted for seven years. The scientific results of this work were of the utmost value. The existence of Permian rocks in this country was demonstrated by it, and many other facts in stratigraphy and paleontology brought out. Nor were its practical results less striking. The twenty-seven thousand square miles of coal beds in Missouri were unknown before its time. The civil war brought the survey to an end. In 1865, appointed State Geologist of Kansas, Professor Swallow worked there for two years. In 1870, returning to Missouri, he was given the chair of agriculture and geology in the State University. Later he was made dean of the College of Agriculture. After many years of faithful work for Missouri, Dr. Swallow removed to Montana, where he has had much to do with the development of mining interests. He still lives, a happy and respected octogenarian, with an honorable career behind him.

Garland Carr Broadhead came of good English and English-Scotch ancestry. He was born in Albemarle County, Virginia, October 30, 1827. In September, 1836, his father moved to St. Charles County, Missouri. His early instruction was gained from his parents and from private tutors, but in 1850 he went to the State University at Columbia, where he first became interested in geology. With the intention of becoming a civil engineer, he then attended the Military Institute of Kentucky. There he met Colonel Richard Owen, brother of David Dale and Robert Dale Owen, and his interest in geology was greatly increased by this acquaintance. In 1852 he began professional work in railroad construction and map-making in Missouri. After four years on the railroad he accepted the appointment of assistant in the State Geological Survey, which he retained until the work was discontinued in 1861. From that time on until 1868 he was in railroad or national Govern-

ment service. In that year he resumed work in pure science as assistant on the Illinois State Geological Survey. On the reorganization of the Missouri State Geological Survey he was appointed assistant, and in 1873, as State geologist, took entire charge. The survey was discontinued in 1875. Mr. Broadhead has continued to contribute to geological science since that time as juror in expositions, expert in Government service, and otherwise. In 1887 he was appointed to the chair of mineralogy and geology at the State University at Columbia, S. C., which he still holds.

After the fire and Shumard's death, it is no wonder that signs of discouragement showed themselves; no wonder that in his annual address—the fifteenth—Dr. Engelmann mourned the condition of affairs. The membership of the society was reduced. "Some are dead, others have removed from here, and few remain to help the work, and this is the greatest difficulty we labor under; scarcely any have come to St. Louis to step into their places and work, no new generation grows up to take the work when the pioneers of the academy have departed." There had at this time been no publication since 1868, hardly anything since 1866; on the whole, it was the darkest hour of the institution's history. New life and new energy were to come. The school board, with whom they had been so long negotiating for new quarters, acted with promptness after the fire, and meetings were held in their rooms, and later in the Polytechnic Institute; in November, 1871, the school board voted five hundred dollars for cases in the institute; in January following the St. Louis Public-School Library offered to pay for the bindings of the unbound books. In January, 1872, there began negotiations looking toward a permanent home. At that time, James H. Lucas proposed to present a plot of ground to the Missouri Historical Society for a building. President Johnson, of the academy, secured permission for the institution to co-operate in the building. On June 8th Mr. Lucas presented a lot of fifty by one hundred and nine feet, on condition that the two societies should put up a joint building. Both of the organizations took up the matter; committees were appointed, various plans and schemes were suggested or attempted; fifty thousand dollars was the sum to be secured. The subscription did not go well; plan after plan was tried; appeal after appeal was made in the presidential reports. Local pride was prodded by reference to a sister institution: "Davenport, Iowa, is about to dedicate a building to the service of science, and the funds to erect it were obtained almost wholly by the persistent efforts of a single lady." The original gift was conditioned upon the building being begun within five years after the donation; at the request of the society this condition was modified. Finally, after seven years had passed, in

1869 Dr. Engelmann advised giving up or selling their share in the lot and purchasing the Mary Institute—the female branch of the Washington University—for the purposes of the academy. Twenty-five thousand dollars would buy the building, of which five thousand was already promised; twenty-five thousand dollars more would be needed for equipment. In 1882, when the society had reached the age of twenty-five years, it was still without a home; it had just moved, however, into the Washington University, where it had a meeting room and space for its small museum and library free of rent. In 1893 the plan for building was revived, but failed, and to-day (1897), when forty-one years have passed, the society is still homeless. Its interest in the Lucas lot was long since converted into cash, and forms part of its present fund. The Historical Society has become the owner of a well-located building, and the academy occupies quarters at present in it. A meeting room is situated on the ground floor; it is supplied with oil portraits of the presidents and prominent past members of the academy. In upper rooms, not particularly easy of access and not at all adapted to their use, are a reading room and the library. Here, too, is stored away the supply of Transactions held for distribution. No attempt has been made for some years to secure museum collections, and what few specimens the academy owns are either stored away or displayed in some other institution.

Although the publication of the Transactions had at one time been almost discontinued, three volumes had appeared, crowded with important papers. The appearance of the fourth volume is connected with one of the most serious blows received by the academy. This volume was published by Dr. George J. Engelmann as a memorial volume to his father. George Engelmann, who had been with the academy from its start, one of the founders of the old Western Academy in 1836, died in February, 1884.

George Engelmann is a name which will live long in the annals of American science. A native of Germany, he was born at Frankfort-on-the-Main, February 2, 1809, and was the oldest of a family of thirteen children. In 1827 he held a scholarship at Heidelberg; in 1830 he was at the University of Berlin, and in 1831 he graduated, an M. D., at Würzburg. His dissertation was upon Plant Teratology; it possessed unusual merit, and attracted wide attention among the masters in the subject. In 1832 he was at Paris for medical study, but in the fall of that year sailed for this country to serve as agent for friends looking to investment in America. At that time the Mississippi Valley was truly frontier. Dr. Engelmann tarried for a time in Illinois, then traveled in Arkansas and adjacent districts, but finally, in 1835, settled at St. Louis to practice medicine

After four years he left his practice with Dr. Wislizenus, and went to Germany to marry Miss Dora Horstmann, to whom he had been engaged for ten years. The following year, in 1840, Dr. and Mrs. Engelmann came to St. Louis. We have already mentioned Dr. Engelmann's interest in the Western Academy of Science in 1836-'37. It was in 1835 that he began the remarkable series of meteorological investigations and records which were kept up continuously for nearly fifty years. In 1842 he published his important monograph upon American *Cuscutinæ* in the American Journal of Science and Art. The paper caused a true sensation in botanical circles. In 1848 he prepared the report upon the *Cactaceæ* of Doniphan's Rio Grande and Mexican trip, and later the important reports upon the *Cacti* of the Pacific Railroad survey and the Mexican boundary. These papers, the standard authority upon this interesting and important family of plants, are a monument of accurate and careful work. Dr. Engelmann was a considerable traveler. He made many journeys to the West and South, and to Europe, always to the profit of botanical science. There existed between him and Asa Gray and Charles C. Parry the kindest sympathy and deepest regard. On many of his journeys Mrs. Engelmann was his companion. Between the two there existed the most delightful companionship and love. Early in 1879 she died, and it might almost be said that he was never happy again. In vain his friends attempted to cheer him. A trip to the Pacific coast in company with C. S. Sargent and C. C. Parry was arranged, but it failed to relieve his depression or to cure his bodily ills. In the summer of 1883 he went again to Germany, but broke down upon the trip and died soon after his return home. It is significant of the man's interest in his work that, while he was ready to go, he longed to live just one year more, that he might finish out his half century of meteorological observations. During his later years, Dr. Engelmann was in the habit of preparing summaries of the observations for each year, making careful comparisons with the records of preceding years, computing averages, drawing diagrams, etc., for presentation at the academy. Dr. Engelmann's interest in the academy never flagged; one of its founders in 1856, he was rarely absent from any meeting if he was in the city; he served as president sixteen times. Though having many opportunities to publish his botanical notes, he loyally preferred the medium of the Transactions of the academy he so much loved and for which he did so much. The bulk of his literary production is scattered through its pages. There are his papers upon cacti, Rocky Mountain pines, North American juncus, yucca, junipers, firs, agave, oaks, isoetes, the genus *Pinus*, etc.—papers that rank among the best in American botany. Yet all this work was done, not by a

professional botanist, but in the leisure hours of a very busy physician's life. In these days, when there is some tendency to sneer at "amateur scientists," it is well to remember the work of men like George Engelmann.

To completely understand the work of the St. Louis Academy of Science to-day, something must be known of two other institutions—the Washington University and the Missouri Botanical Garden. The three institutions are closely related in their *personnel* and in their work. The reason for their mention at this point is that the garden is largely due to George Engelmann. Henry Shaw was a wealthy business man of St. Louis; he lived in the city, but had a country home and a great property in land outside of the then city limits. Mr. Shaw enjoyed country life and developed a garden, which even then was an attractive place of resort. A friend of Engelmann, the latter was able to direct the rich man's taste into profitable channels; the result was that Shaw's Garden was really a botanical garden. From it has grown an institution of the greatest importance and interest—the Missouri Botanical Garden. It is organized in accordance with the terms of Mr. Shaw's will. The garden proper consists of several acres, upon which stand the old country home now used as the residence of the director, and the former city house of Henry Shaw, which was in accordance with the terms of the will removed from its former site and rebuilt exactly, and which is now used as an office. In this latter building is the botanical library—one of the best in America; two particularly interesting sections of it are the pre-Linnæan and the Linnæan libraries. Here, too, is the Engelmann herbarium, containing rich series of important type specimens. This valuable donation to the garden was made by Dr. George J. Engelmann, son of the botanist. A graceful thing done by Mr. Shaw shortly after Engelmann's death was the republication, in one quarto volume of 508 pages and 103 full-page plates, of all of Dr. Engelmann's published botanical work. The garden also has now in its possession the Engelmann library and all the original notes and botanical sketches made by Dr. Engelmann. The mass of these notes is enormous. Dr. Trelease, to whose care they are intrusted, found twenty thousand slips which, bound up, composed sixty quarto volumes. The garden includes among its features an arboretum of the first grade, greenhouses where experimental work is conducted, experimental gardens for fruits and vegetables, and a Bible garden. This last, an idea carried out in Mr. Shaw's lifetime and still maintained, aims to illustrate the plants mentioned in the Bible. An excellent feature in the work of the garden is the training school for practical gardeners. Six young men are here on scholarships, following a definite course of study; they live upon the place and re-

ceive free tuition, rent, and board; their appointment is by competitive examination. Prof. William Trelease is the director of the Missouri Botanical Garden, and has an able corps of scientific and office assistants and gardeners.

An important part of Mr. Shaw's plan was the establishment of a school of botany, the head of which was to hold the George Engelmann professorship. This school is organized in connection with Washington University; it is closely related to the Missouri Botanical Garden, the directorship of which is also held by the occupant of the chair. In the work of the school Professor Trelease has three assistants; seventeen different courses of instruction are offered by them. Under the direction of the school there are also offered at the garden important courses in elementary botany for children or for busy people.

Washington University is in close touch with the Academy of Science. From its faculty come some of the academy's most active workers and officers. Professors Woodward (mathematics and mechanics), Nipher (physics), Engler (mathematics), Pritchett (astronomy), Trelease (botany), and Hambach (geology) have been conspicuous in its work. To the Transactions of later years they have contributed numerous and important papers. At a time when the academy had no other home, the doors of the university were opened to it for its meetings and the housing of its library and the storing of its collection. The academy is fortunate, indeed, in having been so closely in sympathy with an institution of learning the interest of whose teaching force more than ought else kept it active during a critical period of its history.

Among the most active members who came to recruit the force, which we have seen above from Dr. Engelmann's statement had been somewhat reduced by time, was that master worker in entomology, Dr. Charles Valentine Riley. Born in London, England, on September 18, 1843, he was schooled at Chelsea and Bayswater, at Dieppe, France, and at Bonn, Germany. In 1860 he came to this country, settling upon a farm in Illinois. Removing to Chicago, he began editorial work upon the *Evening Journal* and the *Prairie Farmer*. Near the close of the war, May, 1864, he joined the 134th Illinois Volunteers. When the war ended he resumed his editorial labors on the *Prairie Farmer*. In 1868 he was appointed State Entomologist of Missouri, a position which he ably filled until 1877, when he was made chief of the commission appointed by the United States Government to investigate the ravages and life history of the Rocky Mountain locust. The greater part of the reports of this commission was written by him. In 1881, when the commission was merged into the work of the Agricultural Department, Dr.

Riley organized the entomological division of the department, and became its head. At the same time he became curator in entomology of the United States National Museum, to which he donated his magnificent private collection of insects, containing more than fifteen thousand specimens. Dr. Riley at different times lectured upon entomology at various institutions—Cornell University, Missouri State University, Washington University, etc. He was a diligent writer. A man of energy and decision, he was also of most amiable character, and was much loved by his friends and colleagues. The honorary degree of Ph. D. was granted to him in 1873 by Washington University. The French Government, in 1873, and the Edinburgh Forestry Exhibit, in 1884, conferred upon him gold medals in recognition of his work.

In 1835 there came to St. Clair County, Illinois, a talented German, Theodore Erasmus Hilgard. A lawyer by training, he there settled down to country life. He introduced the culture of the vine into Illinois. The town of West Belleville was laid out upon his property and under his direction. He delighted in himself conducting the education of his family, and his three sons, Julius Erasmus, Theodore Charles, and Eugene Waldemar, all attained prominence in American science. In 1851 he returned to his native land by invitation of the Bavarian Government to aid in recasting the national laws regarding mortgages. Although he again visited this country, he did not remain here, but finally settled at Heidelberg, where he died in 1873. He was a poet and a man of letters. His second son, Theodore Charles Hilgard, was prominent in the academy's work for many years. He was born in Zweibrücken, Germany, February 28, 1828. While a young man in his Illinois home he collected botanical specimens for George Engelmann. Later, he studied medicine in European schools—Heidelberg, Zurich, Vienna, Berlin—and settled down to practice in St. Louis. In 1854 he published his *Experimental Observations on Taste and Smell*. At various times he presented papers on botany—especially on *Phyllotaxis* and kindred subjects—before the academy. These were printed in the Transactions. Obligated on account of failing health to abandon medicine, his studies were turned to microscopic forms of life and to terrestrial magnetism; in the latter subject he assisted his brother Julius, to whom it was professional work. He died in New York, March 5, 1875.

For two years James Buchanan Eads was president of the academy, and was associated with it for a much longer period. No member of the academy has had a more conspicuous career. It was "he who devised and furnished our Government with its first and most useful armored steamboats, who built the St. Louis Bridge; who

made one of the shallowest mouths of the Mississippi permanently navigable for ocean steamers." The story of his life reads like a romance. Born at Lawrenceburg, Indiana, May 23, 1820, he was even as a small child passionately fond of machinery. The family



JAMES B. EADS, LL. D.

moved to Louisville when he was nine years old. At ten years he was busy making models of all sorts of machines—sawmills, fire engines, steamboats, and steam engines. Financial reverses forced him to take care of himself at the age of thirteen. At that time the family moved to St. Louis, and, curiously, the steamboat on which they were traveling burning, the boy found himself on shore, barefooted and coatless, upon the very spot where later he was to locate the abutments of the great and famous bridge. For a time he sold apples on the street. Then, securing a position in a mercantile house, he

labored diligently, reading in his leisure hours books borrowed from the library of one of his employers. In 1839 he was purser on a river steamer. In 1842 he invented a diving-bell boat to recover cargoes from lost steamers, and later a boat to raise sunken steamers. In 1845 he sold out his interest in this business, and started a glass factory, which completely failed in two years. Helped by his creditors to a small capital, he returned to the work of raising wrecked steamers, and in ten years he was out of debt and had business interests worth five hundred thousand dollars. In 1861 there began those great public enterprises which rendered his name famous the world around. At the request of the Government he designed and constructed a squadron of ironclad river gunboats. The next year he built others, some of which bore turrets of novel pattern, in which the guns were worked by steam. In 1874 he completed the St. Louis Bridge, a marvel of engineering, in the building of which several new problems had to be solved. Later on, in the face of doubt and lack of confidence, he devised and carried on to successful completion the jetty system at the mouth of the Mississippi. Had his ideas with reference to the improvement of the river farther up been carried out, there would be

fewer bursting levees to-day. The great engineer died March 8, 1887.

Dr. Engelmann's meteorological investigations were of the utmost importance, and are fully recorded in the Transactions. He was not, however, the only worker along this line. Dr. Wislizenus was devoted to the same subject. Among his observations was an extended series upon atmospheric electricity. While his work did not lead to that practical application which he had hoped, the record of his experiments is interesting and valuable. Under Prof. Francis E. Nipher there was organized the Missouri State Weather Service, one of the most creditable State organizations ever established. As long as the direction of this service remained local, Professor Nipher was in charge. The scope of the service included the whole State, and the plan involved the appointment of one observer for each county. Work was begun in December, 1878. Some of the results of this State weather service were contributed to the academy and published in its Transactions. Thus, in 1888, there appeared a summary of the results of ten years of labor, including important rainfall maps. Even more important was the Magnetic Survey of the State undertaken by Professor Nipher, and carried on almost wholly at his own expense. The annual reports of this survey regularly appeared in the Transactions.

Dr. Frederick Adolphus Wislizenus, whose name has so frequently been mentioned in this sketch, was born May, 1810, at Koenigsee, in Schwarzburg-Rudolstadt, the son of a Protestant minister who was perhaps of Polish descent. In 1828 young Wislizenus began the study of medicine at Jena, pursuing the work at Göttingen and Würzburg. On account of political difficulties he was obliged to go to



A. WISLIZENUS.

Switzerland to finish his education, and in 1834 graduated from the University of Zurich. In 1835 he removed to New York to practice his profession. He was there at once a physician, political pamphleteer, and poet. In 1837, with certain friends

who had been exiled from their own land, he removed to Illinois, practicing at Mascoutah for a time, but finally removed to St. Louis. In 1839 he went into the far Northwest on a fur-trading expedition. While there he spent some time among the Nez Percés Indians. In 1840 he began practice in St. Louis, where his influence among the German population, both politically and otherwise, was great. Some time later he joined a Mexican trading expedition, taking with him a good scientific equipment; he was, however, seized and imprisoned at Chihuahua, and was only liberated on the arrival of Colonel Doniphan's troops there in 1847. He remained with those forces in a professional capacity until they were disbanded in the summer of 1847, when he returned to St. Louis. The next year an official report of the scientific results of this journey appeared at Washington; it was entitled *Memoir of a Tour to Northern Mexico*, and contains geographical, geological, topographical, astronomical, and barometric observations. He brought home many plants, which were afterward worked out by Engelmann. While in Washington, Wislizenus met Miss Lucy Crane, sister-in-law of Hon. George P. Marsh. In 1849 a cholera epidemic raged at St. Louis, throughout which Dr. Wislizenus labored at his profession. Meantime Mr. Marsh had been appointed minister from the United States to Turkey. In 1850 Wislizenus went there, and at Constantinople was married to Miss Crane. They visited various parts of Europe, and on returning to this country, Dr. Wislizenus, leaving his wife in the East, went himself to Panama, with some idea of settling there. In 1852, however, he returned to this country, and settled permanently in St. Louis. He was one of the founders of the academy, and an honored member of various medical societies. His barometric observations and his collections in botany and mineralogy were of value. While Dr. Engelmann was absent in Europe, in 1858, Wislizenus took charge of his observations, becoming so interested that he afterward continued them for himself until 1881, when failing eyesight interfered with the work. He died September 22, 1889.

There are to-day few, indeed, of the original members of the academy alive. Mr. C. P. Chouteau and Nathaniel Holmes are all. Through a large part of its history Mr. Holmes was the secretary of the academy; not himself a professional scientist nor a large contributor to any definite line, he was a man of wide reading and varied interests. He carefully examined everything that came to the society's library through the long period of his secretaryship, and it was his practice to prepare careful papers upon what he read, papers which added much to the interest of the meetings, and often led to important discussions. While Mr. Holmes is not now a resident of

St. Louis—living in the East—his interest in the academy continues. The only other member approaching these pioneers in the length of connection with the academy is Dr. Enno Sander. Dr. Sander's membership dates from the first year of its organization, 1856. For the past thirty-five years he has been the faithful treasurer of



NATHANIEL HOLMES.



DR. ENNO SANDER.

the academy, and at a recent meeting his friends presented to the society an oil portrait of him in commemoration of the completion of so long and careful a service.

The publications of the academy have not been wholly confined to the Transactions. On two occasions special works have appeared under its imprint. First of these is an archæological report by W. D. Potter and Edward Evers. A party from the academy made considerable investigation of mounds in the neighborhood of New Madrid in the southeast corner of the State. The collections were divided for study into three groups. W. D. Potter was to study the pottery, G. J. Engelmann the other relics, chiefly of stone, while Dr. Evers was to report upon the human remains. A quarto volume of thirty pages with twenty-four fine plates, entitled Contributions to the Archæology of Missouri, by the Archæological Section of the St. Louis Academy of Science, was printed. It is devoted to description and illustration of the pottery. So far as we can find, Dr. Engelmann did nothing upon his part of the work. Dr. Evers began his report upon the twenty-seven crania which were

found, but has never completed it. It is much to be regretted that this important work has not been finished. In 1889 the academy sent observers into the field to study the total eclipse of that year. The party consisted of Professors Pritchett, Nipher, Engler, Mr. Charoppin, and Signor Valle. Their report was entitled *Total Eclipse of the Sun, January, 1889. A Report of Observations made by the Washington University Eclipse Party at Norman, California*. The report was published by the academy, and is a quarto of thirty-nine pages, with six plates.

The present form of publication of the Transactions is convenient, and secures prompt dating of the papers read. Important papers are printed, soon after reading, as *brochures* in separate covers. When a sufficient number of these to form a volume has been issued the official minutes of meetings and an index are also issued, and the volume is closed. To give an adequate idea of the range and value of the recent papers printed by the academy would be impossible in this article. But few can even be mentioned. Pritchard, Engler, and Nipher have repeatedly printed articles of great importance in mathematics, astronomy, and physics. A series of most interesting papers upon the relations between plants and insects, and other botanical subjects, has emanated from Dr. Trelease's work in the Shaw School of Botany. The indefatigable librarian, Dr. G. Hambach, who probably knows more of the details of the academy's history than any other man now living, has contributed valuable papers, beautifully illustrated with his own drawings, upon fossil echinoderms. Among other papers by Dr. Woodward are some dealing with points of curious interest to the teacher and the anthropologist. In pure anthropology, Dr. W. T. Porter's three papers upon St. Louis school children—Physical Basis of Precocity and Dullness, Growth of St. Louis School Children, and Relations between Growth of Children and their Deviation from the Physical Type of their Sex and Age—are almost likely to be classical.

After this brief historical sketch it will be well, in closing, to summarily state the present condition of the academy. Two hundred and eight active members are at present on the list, paying annual dues of five dollars each. There are two hundred and four corresponding members. The library contains twelve thousand books and eight thousand pamphlets; it is open certain hours daily. Six volumes of Transactions aggregating 4,539 pages, and twelve *brochures* of Volume VII aggregating 298 pages, have been printed to date. Other publications as above specified have been issued. The exchange list includes 550 scientific institutions. The academy has six thousand dollars of permanent fund, one thousand of which came by bequest from Henry Shaw, one thousand from savings, and

the balance from the Lucas lot. Regular meetings are held twice monthly. At present it has no displayed collections and no quarters of its own. Surely it should move toward securing these in the near future, as also toward making itself more directly and strongly felt in the life of the city at large.*

* List of presidents and secretaries.

1856. George Engelmann	B. F. Shumard.
1857. B. F. Shumard	Nathaniel Holmes.
1858. F. A. Wislizenus	" "
1859. " "	" "
1860. Hiram A. Prout	" "
1861. George Engelmann	" "
1862. " "	" "
1863. " "	" "
1864. " "	" "
1865. " "	" "
1866. " "	B. F. Shumard.
1867. " "	" "
1868. B. F. Shumard	Nathaniel Holmes; Charles E. Briggs.
1869. " "	Charles E. Briggs.
1870. George Engelmann	" "
1871. John B. Johnson	Samuel Reber.
1872. James B. Eads	William T. Harris.
1873. " "	Nathaniel Holmes.
1874. William T. Harris	" "
1875. " "	" "
1876. Charles V. Riley	" "
1877. " "	" "
1878. George Engelmann	" "
1879. " "	" "
1880. " "	" "
1881. " "	" "
1882. " "	" "
1883. " "	Henry S. Pritchett.
1884. " "	" "
1885. Francis E. Nipher	E. Evers.
1886. " "	" "
1887. " "	" "
1888. " "	" "
1889. " "	" "
1890. " "	" "
1891. " "	E. A. Engler.
1892. Henry S. Pritchett	Arthur Thatcher.
1893. " "	" "
1894. " "	A. W. Douglass.
1895. John Green	W. Trelease.
1896. M. L. Gray	" "
1897. " "	" "

PRINCIPLES OF TAXATION.

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XVI.—TAXATION OF CHOSSES IN ACTION.

IN addition to the review of the celebrated Foreign-held Bond Case (see Popular Science Monthly, vol. lii, No. 3, pages 354–373), decided by the United States Supreme Court in 1893, it is proposed to call attention here to additional and interesting features of this case which have not been hitherto noticed in this connection.

The court having decided the *situs* for taxation of negotiable instruments—railroad bonds, etc.—took occasion also to affirm the taxable *situs* of such other personal property, or evidence of indebtedness, as is generally included under the term of *choses in action*, using in so doing the following language:

“But other personal property, consisting of bonds, mortgages, and debts generally, has no *situs* independent of the domicile of the owner, and certainly can have none where the instruments, constituting the evidence of debt, are not separated from the possession of the owner.”

As thus expressed, the reasons given by the court for separating for taxation the *situs* of the two classes of personal property under consideration are so clear, and so in accordance with common sense, as hardly to require any further explanation; and, therefore, it seems only necessary to assist the reader, who, if a taxpayer, is certainly interested in knowing the tax liability of his property, by recalling that while, in the case of negotiable instruments, the title to the property runs with the instrument and passes by delivery, in the case of bonds, mortgages, and sales made to particular persons, and thus non-negotiable, the title, on the other hand, does not run with the instrument, but exclusively with the person of the owner; so much so, that the attachment of a mortgage, or the possession by theft or finding of a note payable to a person, does not in any degree alienate or impair its original and legitimate ownership. The decision of the court, therefore, brings all classes of personal property under one harmonious and consistent rule for the purpose of taxation, legal attachment, and protection, by affirming that their *situs* as property is only where they are; which in the case of visible and tangible objects and negotiable instruments, is dependent, from the very nature of things, upon actual and not constructive presence, and in the case of *choses in action* upon the domicile of the owner;

and in thus deciding, the court simply followed English precedents of long standing and the highest character.*

It may, however, be objected that the practical effect of this decision has been to relieve all negotiable instruments from taxation, inasmuch as, removed beyond the territory and jurisdiction of the State in which their owner resides, they will not, by reason of easy concealment (for which safe-deposit companies in the larger cities of most of the States now offer great facilities), be easily cognizable by the assessors of the locality in which they are deposited. But admitting the objection in full force, as in all reason we must, what then? The Supreme Court has given its opinion clearly and unmistakably; and until this opinion is reversed, it constitutes the legitimate rule of action for both assessors and taxpayers. But suppose it were possible to reverse the opinion in question, would it be expedient to do so? Would it be desirable to abandon the plain common-sense view that the *situs* for the taxation of all personal property is where the law protects it, and where alone an assessment and a legal attachment against it can be enforced, and in its place make *situs* depend on visibility? And if visibility, what degree of visibility? Shall a diamond, a bar of gold, or a railroad bond, belonging to A. B., residing in Boston, but openly displayed in a jeweler's or broker's window in Philadelphia, be taxable in Pennsylvania, and a similar diamond, gold bar, or bond of the same owner, deposited in a drawer of the same shop or office and not so readily visible, be taxable in Massachusetts? Shall we make the *situs* of property for taxation depend upon the keenness of perception or visual organs of an assessor? Or shall we not rather, admit that the attempt to raise revenue by taxing such property as negotiable instruments which from their very nature are in a high degree intangible and invisible, and thus easy of concealment; which, passing by delivery, are here to-day and somewhere else to-morrow; which are not taxed in any other highly civilized country, and which are in great part, even in this country, specifically exempted by law—i. e., United States bonds, legal tender, national bank notes, etc.—is in itself an absurdity and a wrong; inasmuch as to enforce a levy from one man for one species of property, because through his honesty, ignorance, or inability to escape he can be laid hold of, and allow identically the same description of

* Lord Ellenborough, in *King's Bench (Neilage vs. Holloway, Barnwell and Allison's Reports, 318)*, having decided that a negotiable note was a chattel personal and not a chose in action; Lord Abinger, that all foreign government bonds payable to bearer have a *situs* where they are actually situated; and the House of Lords, that registered stocks and bonds of the United States and of the several States not passing by delivery, are not negotiable instruments, and therefore not taxable as goods and chattels.

property in the possession of another man to escape because of varying circumstances beyond the control of the assessors, is not taxation in any sense, but simply arbitrary taking. The court itself, in referring to the tax under consideration, said with great point and truth: "*It is only one of many cases where, under the name of taxation, an oppressive exaction is made, without constitutional warrant, amounting to little else than an arbitrary seizure of private property. It is, in fact, a forced contribution levied upon property held in other States, where it is subjected, or may be subjected to taxation upon an estimate of its full value.*"

DECISION OF THE SUPREME COURT OF CALIFORNIA ON THE TAXATION OF MORTGAGES.—Any review of the history of local taxation in the United States would be imperfect which failed to notice a notable and interesting decision given in May, 1873, by the Supreme Court of California in regard to the taxation by its State authorities of real-estate mortgages. The question was one that for a considerable time had greatly interested the people of California, and the drift of popular sentiment of San Francisco seems to have been most unmistakably in favor of their taxation. But how to do it, and at the same time not increase the burden on the borrower, who had mortgaged his land as security for a loan of capital to improve or stock it, was a problem that not a little troubled the lawmakers in Legislature assembled. One proposition brought forward contemplated a deduction from the amount of land tax of the assessment on the mortgage; but as the lands of California were found, as a rule, to be taxed far below their value, and the mortgages for a value far in excess of the assessor's appraisement of the land they covered, it became soon apparent that this scheme was to a greater or less extent equivalent to exempting the land and taxing the mortgage. Another proposition, embodied in a bill introduced into the Assembly, was to make void all contracts by which borrowers agreed to reimburse lenders in the amount of the mortgage tax; while others again were exceedingly strenuous in favor of trying the pleasing little experiment—which no community having once tried ever desires to repeat—of providing that the person giving the mortgage should pay the taxes upon it, but be at the same time authorized to deduct the tax from the principal, or interest, in settling with his creditor. Pending these discussions, however, the Supreme Court, which had the question before it on a suit to which one of the savings banks of San Francisco was a party, rendered a decision, that in virtue of a clause in the Constitution of the State requiring all taxation to be equal and uniform, the taxation of mortgages was unconstitutional and illegal; inasmuch as to tax a given property and then tax a mortgage on it, which mortgage is

not in itself property, but, like a deed or lease, is a species of conveyance or acknowledgment of a conditional interest or right in the property, is not equal and uniform taxation, but an unequal and double tax on the property mortgaged.

The importance of this decision, considered as an act reformatory of the popular theory of local taxation, does not require to be proved and illustrated; but as it was unquestionably a step in advance of any heretofore taken by either our Federal or State courts, and as, by reason of it, not only were mortgages exempted from taxation in California, but also all promissory notes and other evidences of indebtedness, it is desirable briefly to ask attention to the reasoning by which the court was led to its conclusions.

The opinion was given by the Chief Justice—Crockett—who, after reviewing the history of the case, is reported to have used the following language:

“I come now to the point, whether a tax on land at its full value, and a tax on a debt for money loaned, secured by a mortgage on the land, is in substance and legal effect a tax on the same property. We all know, as a matter of general notoriety, that almost universally, by a stipulation between parties, the mortgagor is obliged to pay the tax both on the land and on the mortgage. Practically he is twice taxed on the same value, if he has still in his possession the borrowed money to secure which the mortgage was made. The law taxes in his hand both money and land; and by his stipulation he is required to pay tax on the mortgage debt, and also, if the money has passed out of his hands into the possession of some other taxpayer, it is taxed in the hands of the latter, so that the money bears its share of taxation, and the land its share, in the hands of whomsoever they may happen to be.

“It is very true that a voluntary agreement on the part of the mortgagor to pay the tax on the mortgage debt can not improve its *situs*. The State was no party to the contract, and is not bound by stipulation *inter alias*. The burdens of taxation can not be shifted from those on whom the law imposes them by stipulations between private persons; but in the absence of such a stipulation, an inexorable law of political economy would impose upon the mortgagor the burden, in a different form, of paying the tax on the mortgage debt. Interest on money loaned is paid as a compensation for the use of the money, and a rate of interest as agreed on is the amount which the parties stipulate will be the just equivalent to the lender. If, however, by the imposition of a tax on the debt, the Government diminishes the profit which the lender would otherwise receive, the rate of interest will be sufficiently increased to cover the tax, which in this way will be ultimately paid by the borrower.

The transaction would be governed by the same immutable, inflexible law of trade by reason of which import duties on articles for consumption are ultimately paid by the consumer, and not by the importer. The rate of interest on money loaned is regulated by the supply and demand which govern all articles of commerce; and the burdens imposed by law in the form of a tax on the transaction, which would thereby diminish the profits of the lender, if paid by him, will prompt him to compensate for the loss by increasing to that extent the rate of interest demanded. *If his money would command a given rate of interest without the burden, he will be vigilant to see that the borrower assumes the burden, either by express stipulation, or in the form of increased interest. This is the law of human nature, which statute laws are powerless to suppress, and which pervades the whole of trade governed by the law of supply and demand.* Nor would the enactment of the most stringent usury laws produce a different practical result. Human ingenuity has hitherto proved inadequate to the task of devising usury laws which were incapable of easy evasion; and wherever they exist they are, and will continue to be, subordinate to that higher law of trade which ordains that money, like other articles of commercial value, will command just what it is worth in the market, no more and no less. Assuming these premises to be correct, and I am convinced that they are, it results that it is the borrower, and not the lender, who pays the tax on borrowed money, whether secured by mortgage or not; but if secured by mortgage, he is taxed not only on the mortgage and property, but on the debt which the property represents and which is held as a security for the debt." *

Subsequently the Hibernia Savings Society of San Francisco having resisted under the provisions of the Constitution of California the taxation of mortgages given to secure the loan of property, the Supreme Court again met the case fairly and squarely—its language by Justice Wallace being reported as follows: "Mere

* Of the soundness of this decision there could probably be no more convincing illustration than the statement that upon its announcement the savings banks of San Francisco gave notice that they would immediately reduce the rate of interest on their loans secured by mortgages by the amount of the tax on the mortgage. And the *Alta-California* of May 9th, in commenting upon the decision, says: "When the news arrived here yesterday morning" (that the Supreme Court had given a decision) "it was not unexpected; and the idea conveyed by the false rumors set afloat, that the decision was adverse to the savings banks, was accepted as a decision measured by expediency, and not based on sound legal principles. Special dispatches received changed the result; and when it became evident that the banks and the mercantile community had triumphed, a general feeling of satisfaction was everywhere noticeable. Merchants, bankers, and taxpayers generally received the news with the feelings of men who felt relieved from a terrible incubus."

credits are a false quantity in ascertaining the sum of wealth which is subject to taxation as property, and so far as that sum is attempted to be increased by the addition of these credits, property based thereon is not only merely fanciful, but necessarily the imposition of an additional tax upon a portion of the property already once taxed. The taxation thus imposed, nominally upon credits, having resulted in the double taxation of money, the additional tax must be paid by some one. And here all experience, as well as all settled theories of finance, concur that it is not the lender who pays, but the borrower. The borrower is the consumer; the interest that he pays to the lender is the prime cost of the delay for which he has contracted. If the Government, by the imposition of additional taxes, increase the cost, the borrower, being the consumer, must pay for it."

The court, through Justice McKinstry (the Chief Justice's opinion being in concurrence), enumerated, as follows, some of the absurdities to which an attempt to include *choses in action* in the definition of property would necessarily lead:

"Supposing," he said, "that the necessities of Government required a tax of one hundred per cent on all values, or, what would be the result of such a tax, an appropriation of all the property in the State—it is plain that the State would receive no benefit from evidences of debt due by some of her citizens to others, and payable out of the tangible property which the State had already taken.

"The Legislature may declare that a cause of action shall be taxed, but a cause in action can not pay the tax; and this because it has, and can have, no value independent of the tangible wealth out of which it may be satisfied.

"It may be possible in every case to show that the debtor has paid the tax assessed to his creditor. But it admits of mathematical demonstration—if other property in the State has been assessed at its value—that the money which shall ultimately satisfy the debt (if it ever is satisfied) has paid the tax. If it were practical to assess all the property in the State at the same moment of time, it would be clear to every mind that an assessment of a credit was an attempt to transfer to it a value elsewhere assessed. If a debtor was found to be the owner of one thousand dollars, and is assessed for that sum, and his creditor is found to be the owner of his note for one thousand dollars, and is assessed for a like sum; and if the day after the visit of the assessor to the creditor the debtor shall pay his note, it is clear that this same value has been twice taxed; since the debtor has parted with his money, and received only that which is certainly not taxable property in his hands, and which can never afterward be assessed. When a debtor pays his debt,

he does not abstract or destroy any portion of the taxable property of the State; the aggregate of values remains the same."—*Opinion of Justice McKinstry.*

Suppose, "were such a thing possible, that the entire tax rolls exhibited nothing but indebtedness. Taxation under such circumstances would, of course, be wholly fanciful, as having no actual basis for its exercise."—*Opinion of Chief-Justice Wallace.*

AN APOSTATE DEMOCRACY.

By FRANKLIN SMITH.

WERE the founders of the American Republic to return to the scene of their memorable achievements, that which would surprise them most would not be the railroad or telegraph; it would be the change in the principles and practice of government that has taken place since their day. I do not mean to say that the marvelous discoveries of science would not arrest their attention. By no means were they without appreciation of the things that make for industrial progress. But to them the thing of most importance in the affairs of life was government. They felt that all was lacking where a people lacked the guarantee of freedom and justice. Where these were had, all else was possible. Sooner or later it would come as the triumph of individual thought and effort. Not so now. The government that insures freedom and justice, leaving the citizen to work out his own destiny, moral and industrial, is not the ideal of the statesman and philanthropist of to-day. Reverting to the ideal of feudalism, one that took the Anglo-Saxon four centuries to get away from, they conceive the government to be best that governs most. But in the eyes of the founders of the republic such a government was intolerable; for it was to escape despotism that they fought the Revolution.

These patriots were under as little delusion about the nature of democracy as a political power as they were about the nature of autocracy. What the history of the ancient and mediæval republics had taught them of its capacity for corruption and despotism their own experience had in no way tended to revise and correct. It had accepted bribes; it had exercised a religious intolerance that rivaled the Inquisition; it had sought to fill its exchequer by means as repugnant to honesty and freedom as those of any Valois despot. As ardent a democrat as Jefferson had no more taste for the tyranny of the majority than for any other tyranny. Upon his first inauguration, he seized the occasion to warn his countrymen

against it. "All . . . will bear in mind this sacred principle," he said, proclaiming a truth more honored in the breach than in the observance, "that though the will of the majority is in all cases to prevail, that will, to be rightful, must be reasonable; that the minority possess their equal rights which equal laws must protect, and to violate which would be oppression." Madison, too, rejected the popular superstition that the government of the majority must be synonymous with wisdom and justice. "Wherever the real power in a government lies," he wrote, "there is danger of oppression. In our government, the real power lies in the government of the majority of the community, and the invasion of private rights is chiefly to be apprehended, not from acts of the government contrary to the sense of the constituents, but from acts in which the government is a mere instrument of the major number of constituents. This is a truth of great importance," he added, disclosing a state of the popular mind that the experience of a century has not bettered, "but not sufficiently attended to." As is well known to the students of American history, the Federalists, who now take high rank among the saints of democracy, were even more distrustful of it than Jefferson and Madison. "General Hamilton," says Morris, presenting that statesman in a light that must make his socialistic worshippers feel that they have been burning incense to a false god, "hated republican government because he confronted it with democratical government, and he disliked the latter because he believed that it must end in despotism and be in the meantime destructive to the public morality." * The vehement indictment of bluff old John Adams is worthy of Carlyle himself. "If," he writes, "you give more than a share in the sovereignty to the democrats—that is, if you give them the command or preponderance in the sovereignty, that is, the legislature—they will vote all the property out of the hands of you aristocrats, and if they let you escape with your lives, it will be more humanity, consideration, and generosity than any triumphant democracy ever displayed since creation." †

Men possessed of such views of democracy as a political power were not likely to frame a government based upon the deification of the majority. Never having steeped themselves in the mysticism of political romance and speculation, they did not dream that the state could be wiser and more virtuous than the people that composed it. Nor could they think of it as a beneficent power, exhaustless in expedient and resource, that could, like a fairy, turn their footsteps from every pitfall and, by the wave of a wand, shower upon them all the blessings of existence. What they conceived it to be was

* Van Buren. *Political Parties in the United States*, p. 80.

† Works, vol. vi, p. 516.

more in touch with reality—a voluntary association of citizens with equal rights. What they expected of it was not so transcendent of the limits of the possible—protection in the enjoyment of those rights. In the Declaration of Independence, so much sneered at and yet so deeply rooted in the truths of social science, they announced that all men were “endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness; that to secure these rights, governments are instituted, . . . deriving their just powers from the consent of the governed.” “All men,” said one of the Bills of Rights to be found in the State Constitutions that followed in the wake of the Declaration, “are by nature equally free and independent, and have certain inherent rights, of which, when they enter into a state of society, they can not by any compact deprive or divest their posterity—namely, the enjoyment of life and liberty, with the means of acquiring and possessing property, and of pursuing and obtaining happiness and safety.”* No state socialism here; no feudal regulation of industry or morals: only devotion to a freedom, indispensable to happiness and social development, and a demand for its protection.

Upon the meeting of the convention called to frame a government for the territory wrested from British despotism, there was no purpose in the minds of the delegates more distinct than to insure this protection. Indeed, it was paramount; it dominated every other thought. To “establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity”—such is the simple but noble and adequate motive they ascribed to themselves, a motive hitherto absent from the world of political thought and action. As if apprehensive that these patriots and statesmen had not been sufficiently explicit to guard against despotism, as odious in the government of the many as of the one, the people demanded the amendment that no person shall “be deprived of life, liberty, or property without due process of law; nor shall private property be taken for public use without just compensation.” Later, the apprehension still existing that the provision made to “secure the blessings of liberty to ourselves and our posterity” was still imperfect, another amendment was added. “No State,” it says, putting a restraint upon a despot that has exercised a power far more destructive of freedom than that feared by the fiercest opponent of the Federal Government, “shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States, nor shall any State deprive any person of life, liberty, or property

* Virginia Constitution of 1776.

without due process of law, nor deny to any person within its jurisdiction the equal protection of the laws." Of the pressing need of this restraint, no better proof is to be had than the mass of litigation involving it that has come before the courts since its adoption.

But liberty and justice, the sole warrant of any community to the title of a free democracy, are not born of a constitution, however ingeniously provided with checks and balances or devoutly worshiped in leader and speech. Hardly had the new Government been launched before there was another of the countless demonstrations that the wisest resolution is no certain bar to the greatest folly—that boast as the political quack may of the efficacy of his machinery, it has neither potency nor virtue beyond the people that work it. Despite the sacredness of the Constitution, so piously worshiped by the party in power, it was remorselessly wrenched to add Louisiana to the Federal domain. With like disregard of its inviolable principles of freedom, the alien and sedition laws were passed in a time of peace; and without the excuse of war, the embargo was established. Under the Nemesis of political intrigue, the electoral provisions of the new *Magna Charta* were permitted to lapse without a twinge of remorse. Long before the republic, so solemnly ordained "to establish justice" and to "promote the general welfare," had passed the first half century of its existence, its citizens had discovered how it could be converted into a powerful instrument of private greed. The tariffs of 1816, 1824, and 1828 were progressive applications of the ethics of the robber barons. The American spoils system, an institution sacred to the memory of the most democratic of democrats, was only a metamorphosis in the interest of the politician of the monarchical system of official favorites.

Despite these violations of liberty and justice, the theory and practice of government for the first seventy years of the republic were in the main a realization of Jefferson's ideal. If it had not always been "wise," it had been "frugal." If it had sometimes taken "from the mouth of labor the bread it had earned," it had restrained "men from injuring one another," and left "them otherwise free to regulate their own pursuits of industry and improvement." * Under this *régime* of freedom, the American people wrought the greatest industrial miracle of history. They won a continent from savagery, and turned forests and prairies into farms and gardens; they built hundreds of towns and cities, and established industries of mining and manufacturing of fabulous wealth; they engaged in moral and social reforms that promised a new earth, if not a new heaven. In a word, they exhib-

* American Orations, vol. i, p. 160.

ited a capacity unparalleled since the advent of man to solve "the problems of life" without other impulse than their love of toil and devotion to improvement. But, with the outbreak of the civil war, a new political and social philosophy became the vogue. It was the product of the conditions that always spring from desperate conflicts. Men of action, coping with insurrection, had no taste for the refinements of political speculation, and no use for the limitations of a Constitution. Nothing was of importance to them except the measures that would save the Union. Even freedom, private interests, and cherished institutions had to yield to the exigencies of the hour. Hamilton had feared that "the States, with every power in their hands, will make encroachments upon the national authority till the Union is weakened and dissolved";* but under the terrific stress of war the Federal Government became omnipotent, threatening to reduce them to administrative departments. Whatever power was thought necessary to raise troops, or to provide revenue, or to crush opposition, was intrusted to it or arrogated by it. No matter how violative of moral or economic law, every act was defended, first, on the ground of necessity, and, later, on the ground of wisdom. When the war was over, the Federal Government, which had performed such miracles, had not simply become all-powerful; it had become all-wise. There was no work it was not thought fitted to do.

When account is taken of the resistless influence of war upon thought and institutions, the revolution wrought in the theory and practice of government in the United States within the past thirty years does not belong to the domain of mystery. It is not to be classed as an inscrutable decree of Providence, designed to hasten the work of civilization. This enlargement of the sphere of government and the loss of freedom it involves have a less cheerful significance. They mean that a nation has suffered from the ravages of conflict. Instead, therefore, of welcoming the change as a beneficent "tendency of the times," to use the current phrase, it should be resisted as an onslaught of the forces of barbarism.

To be sure, the founders of the republic had not worked out with Mr. Spencer's precision a theory of government. Science had not put them in possession of the knowledge that has enabled him to define the limits of public authority. Yet in their denunciations of British despotism and in the Bills of Rights with which they prefaced their Constitutions, they set forth principles quite as hostile as those of his Justice to the state socialism now current. Neither did they apply with his rigor of logic the principles of freedom they did proclaim. Widely, at times, did they depart, as I have said, from

* *American Orations*, vol. i, p. 46.

their political creed. But if not averse to the encouragement of industry that a moderate tariff would give, they never imagined that the throttling of trade, such as began with the Morrill act and ended with that of Mr. Dingley, would come to be defended as a blessing in itself, and turned into a gospel of national wealth and happiness. Nor did they conceive that the Constitution, framed while the memory of the countless evils of an irredeemable currency was still fresh, would ever be quoted in approval of a step so calamitous. Least of all did it occur to them to resort to the power of taxation to suppress the right of a bank to issue its notes, and, with such tyranny as a precedent, to crush a growing traffic in a wholesome food, like the chemical substitutes for butter and cheese, and to extinguish a gambler's passion, like the patronage of a lottery or the solution of missing-word puzzles. They believed with Mr. Spencer that government had a different object. When, however, a nation becomes perverted, as Americans have been, by the evils and ethics of war, the maintenance of peace and freedom ceases to be an article of passionate faith; it is no longer an object of ceaseless pursuit. With ideas and feelings unconsciously and irresistibly shaped, not by constitutions and rational discussion, but by militant necessities, people do not look to themselves for the blessings of life; they look to the power that has shielded them from ruin. To it they intrust, without a doubt of their wisdom or a suspicion of their enslavement, a thousand duties that they alone should assume.

It is not the ignorant and thoughtless that fall a prey to the operation of a social law that they do not understand. People of intelligence and learning as well yield to the bondage of their environment. A member of the United States Supreme Court has repudiated as completely as any blatant socialist the peerless truth that the only government of a free democracy is the one that Jefferson described—the one that “shall restrain men from injuring one another” and “leave them otherwise free to regulate their own pursuits of industry and improvement.” In an address before the American Bar Association, Justice Brown endowed the State with the paternal authority of a feudal despotism. “It may,” he said, “fix the number of hours of a legal day's work, provide that payment be made at certain stated periods, protect the life and health of workingmen against accidents or diseases arising from ill-constructed machinery, badly ventilated rooms, defective appliances, or dangerous occupations, and may limit or prohibit altogether the labor of women and children in employments injurious to their health or beyond their strength. . . . It may,” he added, describing still further the attributes of a government of the fourteenth century instead of the nineteenth, “by constitutional amendment, if necessary, for-

bid the charter of business corporations for any other purpose than those of mining, manufacturing, insurance, or transportation, and especially may inhibit those for farming and trading purposes, or trafficking in any manner in the necessities of life. . . . It may put an end to combinations having for their object the control and monopoly of particular articles of manufacture. . . . It may put a stop to the vicious system of building railroads and other public works through construction companies organized by the directors of their road in their own interest." He went so far as to express his belief that, if need be, the State might limit the size of bequests. "With its unlimited power to dispose of decedents' estates," he continued, "I know of no reason why the Legislature may not limit the amount which any single individual may take by gift or devise, and thus bring about, to a certain extent, the breaking up of enormous fortunes upon the death of the owner." Becoming the victim of a principle based upon a false practice, he plunged to deeper depths of paternal despotism. "I have never been able," he argued, as is so frequently done these days, "to perceive why, if the Government may be safely intrusted to carry our letters and papers, it may not with equal propriety carry our telegrams and parcels; . . . or why, if our municipalities may supply us with water, they may not also supply us with gas, electricity, telephones, and street cars." *

Were such apostasy to the principles of the founders of the republic confined to the expression of opinion, there might be little occasion for protest or alarm. But it has passed into legislation, both State and Federal, there to work its inevitable havoc, both moral and industrial. Since the close of the war, the laws proposed and enacted in Congress have constantly increased in scope and volume. The solicitude of statesmen is not that of Hamilton and Jefferson—to make the Federal Government the preserver of peace and the protector of freedom—but to convert it into a universal beneficence to fit out fools with brains and to render innocuous the virus of indolence and perversity. Upon the assumption that the American farmers, who have solved so many problems, from the extirpation of beasts and savages to the reclamation of forests and bogs, are no longer able to cope with a grub or beetle or to renew the life of an exhausted soil, an insignificant bureau has been turned into a great department of state. Not only has it been charged with the distribution of seeds, often more valuable to politicians than to agriculturalists, and of voluminous reports more common in junk shops than in libraries, but it has just been authorized to furnish its helpless wards with sample stretches of model roads. As if those miracles of

* Proceedings of the American Bar Association, 1893, p. 235 *et seq.*

industrialism, the railroads of the country, had fallen into the hands of incompetent knaves to be used to plunder and impoverish their patrons, a powerful commission has been mercifully provided to avert the disaster. So slight is the confidence to be placed in the integrity of the men of genius intrusted with the solution of the difficult and complicated problems of transportation that they are denied the freedom to make the needful agreements to forestall the ruin of cutthroat competition. With the faith of idolaters in a state supervision that has been pronounced a failure, the apostates propose that the Government shall depart still further from its legitimate functions, and assume itself the ownership of the railroads, thus adding billions to the spoils to be fought for in caucus and convention. Enamored of the dubious success of the Postal Department, whose wretched management has furnished a deficit for sixty years, they demand that it shall saddle itself with a telegraph service and a savings attachment. A postmaster general has so far taken leave of his senses as to suggest that the savings shall be devoted to the construction of public buildings, which would necessitate the taxation of the depositors to meet the interest paid to them, and make it impossible to provide ready money in case of a run. But it is not alone in the regulation of the great interests of life like agriculture and transportation that the Federal Government has favored the American people with its paternal care and superior wisdom. Descending to more personal matters, it has begun to look after their food and drink. I have mentioned the legislation against the chemical substitutes for butter and cheese. Other legislation, equally violative of personal freedom, seeks to rescue the country from the degradation due to the cheaper grades of tea. Thanks to enlightened statesmen, it must be over a brew of the leaf that has met the official test that the assassins of character will continue the pursuit of their favorite diversion.

The loss of freedom involved in the thousand restraints upon activities that have no kinship with crime is not, however, the most odious product of the civil war. That distinction belongs to the spirit of proscription that now animates the American people—the spirit that formerly took, and still takes to some extent, in the militant countries of Europe, the hideous form of a barbarous persecution of the Jewish race. For three quarters of a century they boasted that the United States were the refuge of the oppressed and unfortunate of all countries. Heartily did they welcome every immigrant, not a pauper or criminal, that was willing to work, no matter whether ignorant or literate, yellow or white. They even sent agents abroad to seduce with stories of freedom and plenty the impoverished victims of military despotisms. With their vast re-

sources undeveloped, they felt, as does every free industrial nation before its apostasy, that too many strangers anxious to better their lot could not come among them and share their blessings. But after the curse of militancy had inclined them, as it inclined the republic of Athens and that of the Dutch, to proscription, they began to change their attitude toward aliens. From the policy of excluding the products of foreign labor, they passed to the policy of excluding foreign labor itself. At the same time they sought to justify themselves with the specious logic that springs from war. Though always contentious of the inevitable triumph of their civilization, they declared that it could not withstand the invasion of Oriental habits and customs. In the face of the fact that no amount of knowledge ever transformed vice into virtue, they insisted that without the test of literacy to bar the ignorance and crime of Europe, the institutions of the republic could not survive. Nothing more hypocritical can be found in the pleas of any of the great brigands of history for their assaults upon the rights or territory of the people ill fated enough to evoke their envy or hatred.

The step from attacking foreigners by prohibitory tariffs and immigration laws to attacking them by means more direct is only a short one. That the American people have taken it already once or twice, and are about to take it again, need cause no surprise. When they were under the domination of slavery, a militant institution stimulative of aggression, it was but yielding to the barbarous impulse that possessed them to annex Texas, to wrest from Mexico a vast domain, and to seek to own the island of Cuba. It was but yielding to the same hateful impulse when, a few years after the close of the civil war, they tried to make Santo Domingo a part of the Union. That act of apostasy to the principles of a free democracy was only averted by the courageous efforts of the few men in public life that still felt profoundly the truths of the Farewell Address. Since then, however, the teachings of Washington have again fallen into disrepute. In the clamor for a "vigorous foreign policy" and the annexation of Hawaii, we have another manifestation of the spirit of aggression that nerved the arm of the slave driver as he wielded the lash and fired him with lust for the lands of other peoples.

The impulse toward despotism since the outbreak of the civil war has not been confined to the Federal Government. The forces of aggression let loose by that terrific struggle have passed to every part of the body politic. It has seemed, in fact, as if they gathered momentum as they became diffused. While the States have not, as already said, encroached upon the rights of the central authority, they have ravaged like flames the field of individual rights. History

does not name the despot that rivaled them in edicts for the regulation of the conduct of his subjects. The enactments of some legislatures number more than a thousand in a single session, and the enactments of all of them more than ten thousand. Is it any wonder that the accumulated mass of these experiments in legislation is fast throwing the law into a state of confusion, defying the labors of lawyers to master it, and of judges to interpret it, and that the American people are beginning to grasp wildly for any scheme that promises deliverance from the evil?

Like the Federal Constitution, the State Constitutions exhibit an anxious desire to rescue from destruction "the unalienable rights." Nearly all of them contain a version of the famous clause of the *Magna Charta*. Were the fundamental principles of government set forth in them rigidly observed, the political despotism that now threatens to overthrow free institutions as completely as in Italy at the close of the middle ages would not be possible. "Absolute, arbitrary power over the lives, liberty, or property of freemen," says the Constitution of Wyoming as well as that of Kentucky, "exists nowhere in a republic, not even in the largest majority." More specific, the Constitution of North Dakota declares that "all men are by nature equally free and independent, and have certain inalienable rights, among which are those of enjoying and defending life and liberty, acquiring, possessing, and protecting property and reputation, and pursuing and obtaining safety and happiness." Nothing could be more admirable than the Constitution of Missouri. It asserts that "all constitutional government is intended to promote the general welfare of the people; that all persons have a natural right to liberty and the enjoyment of the gains of their own industry; that to give security to these things is the principal office of government, and that when government does not confer this security, it fails of its design." The indisputable implication is that the functions of government should be limited to the preservation of order and the enforcement of justice. Were it to undertake anything else, it would not promote "the general welfare"; it would promote the welfare of some at the expense of others. Instead of the system of distribution by private contract, the only equitable one possible, it would introduce the system of distribution by force or favor. Instead of insuring to people "the enjoyment of the gains of their own industry," it would take the gains of some to bestow upon others.

But there is no such correspondence between principle and practice. More even than the acts of Congress do the acts of legislatures illustrate the impotency of any political contrivance, however ingenious, to curb the instincts of a degenerate democracy. Until

recent years the theory of constitution-makers has been that general rules would suffice for the guidance of the patriots that represent the people. But the creed of the Russian highwayman, who offers a prayer before he commits a crime, could hardly be more impotent. Then the theory was adopted that more specific directions would possess a greater virtue. Accordingly, the inhibitions of a statute rather than the principles of a charter became the dominant trait of later constitutions. But all in vain. One has been as impotent as the other. "No act," says the Constitution of Indiana, "shall take effect until the same shall have been published and circulated in the several counties in this State by authority, except in case of emergency, which emergency shall be declared in the preamble or the body of the law." Still, out of two hundred laws passed at one session of the legislature, more than two thirds of them contained the lying declaration that "whereas an emergency exists for the immediate taking effect of this act, it shall therefore be in force from and after its passage." "The General Assembly," says the Constitution of Ohio, repeating a provision common to the Constitutions of other States, "shall pass no special act conferring corporate powers." Yet, of the laws of a single session, fifty were in violation of this provision. A similar provision exists in the Constitution of Tennessee. But only thirty-five of the two hundred and sixty-five acts passed at one session omitted the flagrant falsehood that the "public welfare" required their immediate enforcement. One of these laws so essential to the "public welfare" provided only for the change of the line of a lot. "No county, city, town, or village," says the new Constitution of New York, "shall hereafter give any money or property, or loan its money or credit, to or in aid of any individual, or association, or corporation." To such an extent has this important restriction been disregarded that in one year alone over three million dollars of public funds were put into the hands of private charities. Clergymen and philanthropists even defended the shameless evasion, and the consequent plunder of taxpayers, in the name of humanity.

"Can we believe," said De Tocqueville, grasping sixty years ago the melancholy significance of this want of deference to the most solemn obligations that can be put upon people that govern themselves, "that democracy, which has destroyed the feudal system, will respect the rights of the citizen and capitalist? Will it stop now that it has grown so strong and its adversaries so weak?" If there is little in its contempt for written constitutions to warrant a cheerful answer, there is still less in the most cursory analysis of its State and Territorial legislation. "Statutes have been passed," said Mr. James M. Woolworth before the American Bar Association, giving a glimpse of the character of this legislation, "which have usurped a

man's right to his own, and made contracts for him that he would not have made for himself."

Not the slightest heed is given to the fundamental induction of social science that the advancement of civilization means the enlargement of individual freedom and the growth of moral control. So vast and complex is the machinery of modern industrialism that its management must be left to the people that have staked their fortunes and reputations upon its success. They alone possess the incentive to pursue the line of conduct that shall not evoke the censure of the community, and to make the changes in production and distribution that shall always be adjusted to varying needs and tastes. But the new theory of civilization is that the more enlightened a people become the more unfit they are to shape their own private conduct and to control their own private business. The corollary is that the only power competent to take charge of both and thus avert the untimely crack of doom is the one generated by those marvelous mechanisms of intrigue and corruption—the ballot box and party government. Contemptuous of the irrefutable statement of Buckle that "the best laws which have been passed have been the laws by which some former laws were repealed," legislators are reviving in the New World all the restrictions that crushed the individual and industry in the Old. Creating boards, superintendents, and commissions for almost every conceivable purpose, from the examination of barbers and plumbers to the control of insurance and railroad companies, they are subverting not only personal freedom but local self-government. "One may wonder," says Mr. Gamaliel Bradford in a letter to the Boston Herald, calling attention to this amazing reversion to the despotism of the past, "how many people are aware of the social revolution which is going on year by year at the statehouse; the steady undermining of the local self-government which has been the pride and boast of the State for more than two centuries; the process by which we are being drawn under the centralizing despotism of the Legislature exercised through commissions set up . . . at its pleasure. There are now thirty-four of these," he says, giving figures being rapidly duplicated in other States, "many having extensive executive powers and under no effective responsibility whatever." Like the legislatures themselves, they are new centers of intrigue, corruption, and despotism. Playing the rôle of the old court favorites, intrusted with some monopoly by a complaisant autocrat, they bestow privileges and suppress rights.

The form of property that has most frequently attracted the malign attention of the apostates of democracy is corporate property. Especially provocative of their philanthropy and greed have been those large combinations of capital known as trusts, which are now

the great engines of demagogues to inflame the passions of ignorance and poverty, and to extort blackmail with which to carry on political campaigns and to promote private enrichment. Little or no effort is made to discover whether they are the product of vicious legislation, like tariff laws or imperfect corporation laws, or whether they grow out of economic conditions beyond human control. It is enough that they exist; that, like other members of the society that fosters them, they exercise despotic power; that they serve the purpose of a telling battle cry; that they may be pitilessly plundered. Hence their suppression has become within a year or two a favorite outlet for legislative ignorance, prejudice, and rapacity. Much of the legislation against them is for political purposes, and was never intended to be enforced. But that does not alter the fact that it is violative of the fundamental principles of a free democracy, and indicative of the vice that is fast subverting the purposes of the republic. The antitrust law of New York authorizes one of the most odious practices of the Inquisition—namely, the citation of a witness suspected of a crime under it to give testimony that shall furnish a basis for his indictment and punishment. The antitrust law of Mississippi makes any evidence that a trust or combination intended to affect the price of a commodity, conclusive that the price was affected, and authorizes the infliction upon the innocent of the penalty that should be reserved for the guilty alone. What points could not the authors of such laws have given to the famous despots of history?

The corporate property that has suffered most from the raids of these modern Vandals is the railroads. Originally regarded as the most important and valuable contribution that invention had made to civilization, they were fostered in every way. Now they are regarded as among the greatest of "the social evils" that statesmanship and philanthropy are combating so energetically. By a feat of logic not uncommon to "thinkers" as well as to demagogues, they have been differentiated as creatures of the State, having no rights except those that the State concedes. Upon the vicious theory first proclaimed in the famous Chicago elevator case,* that, unlike other forms of business to meet human needs, they are "affected with public interest," and are not, therefore, private property, entitled to all its rights and privileges, they have been subjected to a despotic supervision that has brought them to the verge of ruin. Denied the right of freedom of contract, one of the "unalienable rights," they are not permitted to make their own rates of transportation. Not

* In this case, it will be remembered, the elevator was private property, built on private land. No one was compelled to use it. Yet, as it was "affected with public interest," the courts decided that the State Legislature could regulate its charges.

believed to be moved, like other commercial enterprises, to seek the convenience and approval of their patrons, they have been forced to construct depots in towns of a certain size, no matter whether business warranted it, to arrange the movement of trains on connecting lines to save a traveler from delay, and to post bulletins to acquaint the impatient public with belated trains and the hour of their arrival. It is assumed by another class of legislation that they revel in the destruction of life and property and the persecution of their employees. One State at least requires the erection of stage planks or the use of trucks for the reception of baggage. In another, locomotives must be armed with lookouts to warn heedless trespassers, and in case of injury or death the company must prove affirmatively that it was not guilty of negligence. In still other States it is provided that there shall be no reduction of salary without a month's notice, no discharge of employees without reasons, if demanded, and no record, or black list, of incompetents or rascals. Even the establishment of relief departments, to which no one is obliged to contribute, is prohibited. To show still further that railroads have no rights that the high-minded legislator is bound to respect, it is provided by one law that they shall pay the charges of other carriers on freight delivered to them; by a second, that they shall issue passes to shippers of certain commodities; and by a third, not confined to railroads, that they shall not employ detectives or other persons to discover dishonesty or to protect their property from the destruction of rioters. In so humane an age as the present, thieves would hardly be refused a privilege so unquestionably just.

As yet but two other classes of corporations outside of elevator and railroad companies have been denied the right to fix the price of their services. This baleful movement of democratic despotism has overtaken telegraph and telephone companies, and threatens the gas and street-car companies. The corporations still free from it have not, however, escaped the blasting solicitude of the social reformers. The owners of mills, factories, and mines have suffered severely from it. But if their hours of toil have been shortened to the verge of disaster; if their discipline of the careless and incompetent has been modified to the point of impotency; if they have had to put up their buildings and to guard their machinery in prescribed ways, not always the wisest; if, in a word, they have been bound and gagged by regulations that rival those with which Colbert throttled the industries of France, the story of their oppression is too much like that of the railroads to need recital. Of more interest because more novel is the oppression of the insurance companies, which, like the railroads, require ability and character of the highest order, and a special knowledge that few legislators take the trouble to master.

Yet they, too, have been treated like fools or knaves. In both fire and life insurance, heavy inroads have been made upon the right of private contract. Fire-insurance companies are forbidden to limit their liability. To encourage the industry of the incendiary, they are denied the right to contest on the ground of fraud the loss they shall pay. Besides crushing their freedom, legislators have raided their revenues. In one State at least contributions are exacted in support of the fire departments in towns of a given size. More onerous than those of fire insurance, the laws in regulation of life insurance declare that the statements made in a policy shall be representations only, and even if false, shall not impair the validity of the contract; that an agreement that a contest shall defeat recovery shall be void; and notwithstanding any provisions of the policy, the non-forfeiture law of the State shall control its interpretation. Official forms of contracts, deemed by Leroy Beaulieu to be the very essence of socialism, are framed and enforced. Although the mortality of blacks is greater than that of whites, no discrimination is permitted; and should an agent wish to add to his business by the abatement of his commissions, he can do so only at the risk of prosecution as a criminal. As well might the physician or attorney be punished for the acceptance of a fee below an official rate.

The vicious assaults of the legislatures upon the rights of corporations are paralleled by equally vicious assaults upon the rights of individuals. Here the police powers of the State have been subjected to the same abuse that has overtaken "the general welfare" clause of the Federal Constitution. Under the cover of them, greed and philanthropy have made equal inroads upon the liberty that Americans boast of so frequently and violate so shamelessly. To such a degree have they been stretched that scarcely a form of human activity from birth to death, both included, has not been subjected to meddlesome supervision. In the absurd attempt of impertinent persons to square the conduct of neighbors to their own notions of right and wrong, the whole field of health, labor, morals, and education has been cultivated with a zeal unequalled in modern times.

Take the laws in revival of the old trade and professional corporations, which were so long a bar to civilization, and did so much to inflame the French Revolution. Those that the plumbers, undertakers, and horseshoers on the one hand, and the dentists, druggists, and physicians on the other, have obtained are as repugnant to the principles of a free democracy as the feudal monopolies of Louis XI and Queen Elizabeth. Yet they have the sanction of the highest court in the land. "In the nature of things," says Justice Bradley, defending this despotic exercise of the police powers of the State,

"it is not every citizen of every age, sex, and condition that is qualified for every calling and position. It is the prerogative of the legislator," he added, framing a rule that would apply to every form of human activity from that of a cook to that of a statesman, "to prescribe regulations founded upon Nature, reason, and experience for the due admission of qualified persons to professions and callings demanding special skill and confidence." * Going a step further in the assertion of this power of a paternal despotism, Judge Napton, of the highest court of Missouri, has declared that "the State legislatures have the power, unless there be something in their own Constitution to prohibit it, of entirely abolishing or placing under restrictions any trade or profession which they may think expedient." Imagine what Jefferson would think of such a doctrine, one that would have obliged him to hunt for a licensed blacksmith to shoe the horse that he rode to the capital to deliver his famous address! Imagine what John Adams would say at the discovery of a law that would not have permitted him to build a drain to his own house, or to buy of a jobber the pipes and faucets needed to repair his plumbing! Would they not be moved to issue a new Declaration, and to fight another War of Independence?

No class of people has suffered more from despotism or has a greater interest in freedom than wage-earners. Civilization made its longest stride when they ceased to be slaves or serfs, and gained the right to go wherever work was to be had and to make with their employers such agreements as they pleased. Still, no class has more completely falsified the praise of Sir Henry Maine, the highest that can be paid to a free democracy. "The American people," he wrote scarcely more than a decade ago, "are still of the opinion that more is to be got for human happiness by private energy than by public legislation." To-day it is upon the State rather than public opinion on the one hand, and industry and frugality upon the other, that toilers have come to rely for the redress of grievances and the procurement of abundance. Guilty themselves of every act of aggression they complain of, they have had enacted the most despotic and discriminating legislation to be found in the statute books.† Besides the well-known laws in regulation of the work of women and children, there is a multitude of other laws still more destructive of freedom. I have mentioned those that require rail-

* Quoted by Tiedeman. *Limitations of the Police Power*, p. 202.

† According to Mr. F. J. Stimson, the labor laws enacted during the past ten years number sixteen hundred and thirty-nine. Of these, one hundred and fourteen have been declared unconstitutional, which explains the hostility of labor to the courts, and its preposterous demand that when laws have once been enacted they shall stand until repealed. (*Atlantic Monthly*, November, 1897, p. 606.)

roads and other corporations to give reasons for dismissals, and forbid them to list the knaves and incompetents. But, whatever be the benefit of such laws, the employees of farmers or merchants have no share in them. Equally odious discriminations provide that goods made by union labor shall have the protection of special labels; that wage creditors shall have the preference over clerks and domestic servants; that in suits for manual services, the plaintiff shall get special attorney's fees from the defendant. To the great inconvenience of labor as well as capital, it is not permitted to pay wages in longer periods than those prescribed, or in commodities other than legal tenders. Finally, there are laws that fix the length of day and the rate of wages on public works, thus plundering the men who have to work a longer day and at the lower wages of free competition. But instead of overthrowing by such enactments the despotism of capital, labor only stimulates its growth. For every bureau, every inspector, every aggression on an employer or a fellow-employee, is another drop of vitriol poured upon its own wounds—another nail driven into the coffin of its own freedom.

Though the descendants of the self-reliant and liberty-loving New-Englanders, the farmers of the United States have also fallen a prey to the vicious principles of an apostate democracy. Many of them have surpassed the foreign-born citizens themselves in their devotion to the political ideas that belong to the military despotisms of Europe. In some of the Southern and Western States, where the Anglo-Saxon blood is purest, the subtreasury scheme, the free coinage of silver, and the government ownership and management of railroads and telegraphs have had their greatest vogue. Only among the peasants of the old *régime* would it be possible to find the prototypes of the men that have lost their skill in wresting a living from an exhausted or a half-cultivated soil, and clamor for the aid of the State in their struggle with the forces of Nature and the competition of their fellows. When some De Tocqueville of the future shall study the subversion of American freedom, what a curiosity will he find in the law with its bureaucratic machinery for the extirpation of the gypsy moth! How he will marvel over the decadence of the people that appeal to the same power to save their fruit trees from the ravages of disease and insects, and their fields from the invasion of noxious weeds! If the farmers themselves fail to apply the remedies that benevolent legislators have prescribed, equally benevolent officials are authorized to destroy the trees found diseased, and uproot the weeds before they go to seed. Similar laws have been enacted for the protection of the health of domestic animals. One provides that sheep must be annually dipped to guard against scab. In the case of cattle suspected of tuber-

culosis, officials may subject them to tests, and, if necessary, seize and kill them. In many States the pedigree of an animal has become more important than that of a man, and any falsification of the family tree of a horse or pig is severely punished. Other legislation assumes that Yankee prudence and shrewdness have passed away. Instead of facilitating redress against all frauds, it contains elaborate provisions in regard to the sale of bogus seeds and fertilizers. Finally, there is a mass of legislation, like beef-inspection laws and laws for the regulation or suppression of oleomargarine, that pretends devotion to the public welfare. But its principal object is to cater to greed and to establish monopolies.

Of the liveliest interest to the philanthropic statesman have been all subjects that relate to humanity, morality, and education. It has seemed as if he thought that without his malevolent interference his fellows would lapse into hopeless ignorance and barbarism. Accordingly, he has been at infinite pains to suppress intemperance, to stimulate sympathy and acts of kindness, and to break down any monopoly of intelligence and learning. In all the States there have been established huge and costly mechanisms for the wholesale inculcation of public and private wisdom and virtue. That no child might, through a perverse inclination or parental neglect, wander from the ranks of the droves crowding the public schools, compulsory education has been established. Agents have been appointed to hunt down little delinquents, and veritable prisons constructed to force them to quaff at the fountains of knowledge. More antagonistic even to the principles of a free democracy are the private organizations invested with the police powers of the State to suppress cruelty and vice. Outside of the machinery of responsible government, they wield an authority not subject to the checks of the police. The State has no more to do with the appointment of their agents, who may be grossly ignorant and incompetent, than with the appointment of the agents of a railroad or insurance company. Although supposed to be superior men, I have known them to practice tricks to catch their victims that would disgrace a knave, and to violate private rights with a recklessness hardly surpassed in Russia. The great mass of legislation in regulation of bibulous habits and customs is another reckless invasion of private rights. Without trying to discuss a subject that would fill a volume, I may mention two laws at least that illustrate in an alarming way the assimilation of democratic institutions with those of feudalism. One is the liquor law of New York, with its multitude of despotic and discriminating provisions, inviting evasion, and its centralized officialism, already shown to be grossly inefficient, if not depraved, to enforce them. The other is the dispensary law of South Carolina, which has created

a far more powerful bureaucracy, and has led to much greater social and political demoralization.

The spirit of proscription as well as restriction, so conspicuous in Federal legislation since the civil war, is also potent in State legislation. The Federal Constitution has, of course, made it impossible to establish tariff barriers between the States. But the exaction of licenses of commercial travelers and other checks to inter-State commerce show no lack of will or effort to evade the provision. More successful schemes to prevent foreign competition have been the laws that exclude non-residents from oyster beds and salmon fisheries. Other legislation, equally repugnant to American freedom, forbids to citizens or corporations of other States the ownership and operation of railroads. The feeling against the residents of foreign countries is still more irrational and hostile. The immigration offices established in many States during the period of enlightenment and tolerance have, I believe, with but a single exception, all been abolished. Not only have some of the States forbidden the employment of aliens on public works, but they have forbidden them the ownership of lands within their borders. So rampant has the spirit of intolerance become within the past two years that their exclusion from all other forms of investment has been suggested. Yet we continue to boast of American freedom and enlightenment!

Without tracing the apostasy of American democracy into the narrower but not poorer field of municipal legislation, with its countless ordinances from the regulation of the use of nursing-bottles to the suppression of department stores, let us inquire into the fruits of these exhaustive labors of philanthropists and statesmen. Let us ask whether the one have been commensurate with the other. Have the American people been made moral and humane? While more insistent upon their own rights, have they become more considerate of the rights of others? Can it be said, in a word, that social, political, and industrial life to-day indicates a higher civilization than before the war?

Not to one of these questions can an affirmative answer be given. At no time since the adoption of the Constitution has there been such widespread and well-founded complaint about the greed of capital, the tyranny and brutality of labor, the shocking prevalence of crime, especially lynchings, and the corruption and degradation of politics with the unprecedented growth of the boss system. A legislature does not sit, be it State or national, that is not besieged by men supposed to represent more than any other class the intelligence and morality of the community for favors of every kind—valuable franchises, exemptions from taxation, or other special privileges. The chief argument in behalf of socialism has come to

be that in the management of certain important enterprises they are so indifferent to the public welfare that State control or ownership is the only escape from their exactions. Hardly a great strike occurs that is not accompanied by excesses that only barbarians would commit. When there is no violence, the feeling of hatred on the part of union men toward non-union men takes the form of a persecution more intolerable often than personal assault. Despite primary and ballot reforms and the punishment of bribery, the choice of officials has become more and more the work of a few men, who control caucuses, conventions, and legislatures, and use their immense power to blackmail individuals and corporations to enrich themselves or to advance their political fortunes. As to the grosser forms of crime, the multitude of laws passed to check it has proved equally impotent. Of the prevalence of hoodlumism, even in New England, the home of the Puritan, Prof. Charles Eliot Norton has testified in words of astonishment and alarm. Speaking of the murders throughout the country, Dr. Andrew D. White has stated in a public lecture that they number more than ten thousand a year, and are increasing at a frightful rate. Lynch law is no longer confined to the South, so terribly ravaged by the civil war, nor executed upon negroes alone, nor prescribed only for assaults upon women; it has extended to the North and the West; whites are included among its victims, and robbery or murder suffices to invoke its application.

To many social philosophers such phenomena have been as inexplicable as they have been startling. "Why is it," they ask themselves, "that the more we strive by laws and ordinances to hasten the dawn of the millennium, the darker the heavens get? Is democracy a demon that is not amenable to restraint? Is it destined to triumph over the forces of righteousness, and wreck the very civilization that brought it forth?" Yet they go on believing that these thousands and tens of thousands of edicts of despotic democracy, which work a moral as well as economic havoc that passes computation, are so many novel and valuable experiments in social science—so many attempts more or less successful to solve its great problems. As though every other despot from time immemorial had not made them before; as though, in civilized communities, where moral control is fast taking the place of political control, they could produce any other effect than the one so greatly feared! It is not by sowing the wind that the whirlwind is laid. It is not by acts of aggression, no matter how pure their motive or lofty their aim, that the world is bettered. For, gild the deed as we may, every law passed, every office created, every dollar appropriated beyond the preservation of order and the enforcement of justice, the great

purpose of the founders of the republic, is an invasion of freedom and a step toward degradation. As has invariably happened, and as Hamilton so clearly foresaw, such a policy will eventually turn the most civilized people into a race of barbarians, prone not only to assail one another but to attack their neighbors at home and abroad. In another way, and in that way only, must the goal of human existence be attained; it is to put within the reach of the poorest and weakest the means to resist the rich and strong. Instead of spending countless millions upon a work that should be left to the people themselves, the work of education, the regulation of morals, labor, and trade, the initiation and management of industrial enterprises, spend them, if need be, upon the establishment of a scrupulous justice free to all. Then will it be possible to mitigate and, in time, to end the countless evils of vice and crime that come of war and despotism. Then will people learn to provide for themselves the thousand blessings, moral and material, born of peace and freedom. Then will be solved the only problems of democracy that require or admit of solution—the simple but weighty problems of self-support and self-control.

FABRIC-MARKED POTTERY.

BY F. S. DELLENBAUGH.

THE cord markings on American pottery have been usually ascribed mainly to a desire on the part of the aboriginal potter for decoration. While this may in some cases have been the purpose of the application of the fabrics, which are so distinctly seen in the casts made by Mr. Holmes, it has occurred to me that originally the decorative purpose, if there was any, was quite a secondary matter, and that the real object of the net or coarse fabric was to aid construction. It was one of the means invoked by the primitive potter to enable him to handle his pot or jar when complete and before it could receive the firing.

As these vessels show no evidence of the "coil" process, he must have used some kind of a mold or form. If built on interior molds of indurated clay, as has been suggested,* there would be great difficulty in removing the pot from the mold, hence it seems to me this was not the kind of mold used.

The earlier potters probably used baskets that came up to the curved-in part of the jar, which was continued above the basket by

* George E. Sellers. *Popular Science Monthly*, vol. xi, p. 573.

deft handling, or, if a basket of the same form was followed, the basket was destroyed in the firing process. This would seem to the modern mind a great waste of time and material, but it must be remembered that the Indian potter had not learned modern haste, and besides could turn up a coarse basket in a very short time. Therefore it does not seem improbable that he may, in the early stages, have modeled his jar on the *inside* of a basket frame of similar form and then allowed the basket to be consumed in the baking



FIG. 1.—A FABRIC-MARKED JAR.

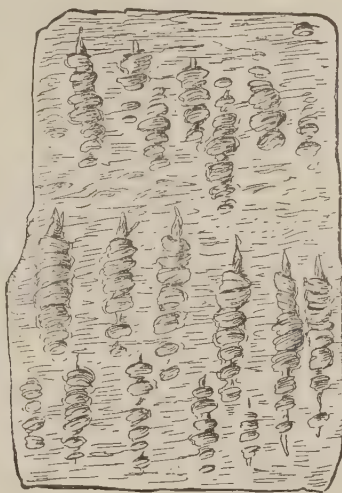


FIG. 2.

process when it could not be separated from the vessel. Even when he developed to a point beyond and modeled the upper portions with a free hand, he would find great trouble in separating his jar from its framework. What, therefore, would be the following step? It seems to me it would have been the placing between the clay and the mold of a piece of netting, which would permit him to lift out his jar easily and intact, and transport it to the drying place. He would then speedily discover that his basket was not necessary—was not so serviceable, in fact, as a hole in the ground, for the sides of the hole could be plastered with a layer of very sandy clay, and thus would all sticking of the vessel to its mold be avoided.

The netting, or fabric, having been spread as evenly as possible over the inside surface of the mold hole, the upper edges were allowed to lie out upon the ground. The soft clay being now pressed evenly upon the fabric to the required thickness, the sandy surface of the mold hole easily gave it shape and gave the potter

no anxiety about the outside surface. Indeed, he had but one surface to watch till he came to the incurve, if his vessel was to have a narrow mouth. Then, I surmise, he built up roughly a clay mold, well sanded, pressing what was left of his fabric into the inside of this mold as he built his vessel upward. Frequently, doubtless, the fabric was not sufficient to go to the top, which explains why sometimes only a part of a jar shows the cord markings. The jar completed, it was easy to pull away the upper mold shell of clay and by means of the fabric lift the vessel out of the mold hole and remove it to the drying spot, where the fabric was peeled off and handles or other projecting parts added. The cord-markings are plainly shown in Plate XXXIX, from Mr. Holmes's casts:

The distorting and overlapping of the meshes observed by Mr. Holmes were probably due to the gathering in to fit the interior of the mold, for it must be borne in mind that the fabric was not shaped in any way to fit the mold, but was doubtless a fragment of some squarely woven article. Thus gathering and overlapping were necessary to make it conform to the inside surface of the mold.

When coarse basketry was used for a mold that was intended to be removed before firing, the interstices of the basket work were probably rubbed full of a mixture of sand



FIG. 3.

and clay to prevent the finished vessel from sticking or catching, which explains, I think, the peculiarity of design in some cases, for only the more prominent features of the basket work would impress the vessel. In Mr. Holmes's fine paper on this subject in the Third Annual Report of the United States Bureau of Ethnology, the illustrations—Figs. 107, 108, 109, 111, and 112—present this peculiarity of design, due to the fact that the chief members of the basketry were covered by the sand-clay mixture. It seems quite probable that to gain

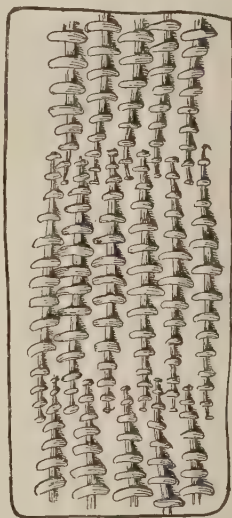


FIG. 4.

stiffness these baskets may also have been put into a ground mold. I have not been able to examine the interstices in the casts Mr. Holmes so cleverly made, but a careful examination would probably show evidences in favor of the mold-hole idea. The fabrics used,

being of a uniform thickness and easily removed, impressed themselves fully upon the exterior surface of the jar, the plain portions being the impress of the smoothed sides of the mold hole. Of the wicker-marked ware, however, only the prominent projections of the form made an impression, the plain surfaces corresponding to the sandy filling that was resorted to for preventing the soft clay from squeezing into and through the interstices. In some kinds of basketry more filling was necessary than in others, which explains the frequent greater separation and irregularity of the markings. For example, Fig. 5 shows far less of the wicker impressions than Fig. 3, and Fig. 2 gives only the irregular salients of an exceedingly coarse support. It seems probable that the wicker-marked pottery is the most primitive, and an extended study of it might lead to a clearer understanding of the beginnings of pottery-making. The next distinct advance was apparently the use of a fabric as a base, supported by some smooth surface, and then as a further development the coil ware, a process still in use among the Moki, and the simplest and easiest way of modeling a clay vessel without the aid of the wheel; progress in pottery, as in other arts, having been in the direction of simplicity of construction combined with skill in execution.

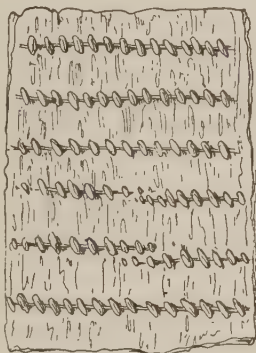


FIG. 5.

The probable line of development in pottery-making was then about like this:

1. Made on the *outside* of a wicker form. Confined chiefly to bowls.
2. Made on the *inside* of a wicker form.
3. Made on netting in mold hole.
4. Coil-made.
5. Wheel-made, which Indians seem never to have attained.

There was doubtless no sharp line of separation anywhere between these several stages, but they merged into each other as the dawn merges into the day.

THE most important of the accessions to the library of Columbia University during 1897 was a gift of 387 books, mainly illustrated works in art, architecture, and natural history. Among them are Audubon's *Quadrupeds*, Sepp's *Nederlandsche Insekten*, Gould's *Humming Birds*, Le Vaillant's *Oiseaux d'Afrique*, and other illustrated works in natural history, many of them colored by hand; a hand-colored copy of Catlin's *American Indians*, Schoolcraft's *Indians*, Pennant's *Archæological and Zoölogical Works*, with rare and valuable portraits, and books on the Baltic provinces, Livonia, and Frisia.

IN A WORLD HALF AS LARGE.

BY THE LATE M. J. DELBŒUF.

LAPLACE says, in his *Exposition du Système du Monde*: "The law of attraction inversely as the square of the distance is that of emanations starting from a center. It appears to be the law of all forces the action of which is perceptible at sensible distances, as we recognize in electrical and magnetic forces. This law, therefore, responding exactly to all phenomena, should be regarded in its simplicity and its generality as rigorous. One of its remarkable properties is, that if the dimensions of all the bodies in the universe, their mutual distances, and their velocities should be increased or diminished proportionately, they would describe curves like those they now describe; so that the universe, thus successively reduced to the smallest imaginable space, would always present to observers the same appearance. These appearances are, consequently, independent of the dimensions of the universe, since, by virtue of the law of proportionality of force and velocity, they are independent of the movement it may have in space. The simplicity of the laws of Nature thus permits us to observe and recognize only these relations."

This masterly page contains propositions of different natures. Some of them are of an exclusively mechanical order; as those which teach that attractive forces, emanating from a center, act in inverse proportion to the squares of the distances; that this appears to be the law of all forces acting at sensible distances; that its simplicity and generality should cause it to be regarded as rigorous; and that the consequence flows from it that we may conceive an infinity of universes mechanically alike—that is, built upon all imaginable scales. These propositions, even if they had not the support of Newton, would acquire an incontestable authority from the single fact that Laplace advanced them.

Other of these propositions lie in the domain of psychology and metaphysics. Such are those that assert that these infinitely numerous universes, built on different scales, enlarged or diminished, would always present the same appearances to observers; and that, consequently, these appearances are independent of the dimensions of the universe, because the simplicity of the laws of Nature permits us to observe and recognize only relations. From all this we are authorized to infer as a final consequence which Laplace does not deduce explicitly, but which was assuredly in his thought, that the universe has fundamentally no fixed, immutable, absolute dimensions; that it is, in short, a purely geometrical universe, constructed in a homogeneous space, of which the proportions have the same

properties, whatever their extent. I propose to demonstrate the fallacy of these consequences.

For this purpose I reduce this proposition to its simplest dimension, and speak, in our planetary system, only of the sun and our globe. If this system and all it contains were reduced to one half the present linear dimensions, if the velocity of the earth in its orbit were one half less, the densities of the sun and the earth remaining the same in homologous points, there would be, according to the theorem of Laplace, no other change than of dimensions, and an observer belonging to the system would not perceive any; only an observer placed outside of the system and having a standard of comparison being competent to notice it.

Or the problem may be presented in another way. We might keep the two systems, the original and the reduced one, inclosing them, in thought, one within the other, with the centers of their two suns coinciding. If the two planets were in corresponding parts of their orbits at the same time, an observer at the common center would see only the smaller one, because it would always conceal the larger.

To make the matter plainer, let us call the fictitious planet Mars. In fact, what we are going to say will nearly apply to the real Mars, whose radius is 0.517 that of the earth, and its density 0.95 that of the earth. We remark, also, that Mars receives only half as much heat as the earth. Our imaginary Mars shall be an exact image of the earth; with the same seas and continents, the same flora and fauna, the same peoples, the same cities, and the same monuments; and a person who might be transported in his sleep would be carried from one to the other, provided his own size was correspondingly diminished, without perceiving that he had changed his abode, so long as he confined his attention to the phenomena of space. If we suppose the year to consist of three hundred and sixty-five days of the same length as our days, which we may legitimately do, there would be no change in the relations of time. Generally, there will be no change in the senses of touch and sight, so far as they relate to surfaces.

Supposing our imaginary Martians to have invented a system of weights and measures resting on a like basis with the French metric system, their measures of length will be of half the value of ours; of surface, one fourth; of capacity, one eighth; and their weights, into the valuation of which other elements will enter, one sixteenth.

Hence, if we suppose the mean weight of an earthly man to be eighty kilogrammes, that of the Martian would be only five kilogrammes.

The difference in the relations of the measure of capacity and the weight deduced from it, according to the rules of the metric sys-

tem, which is brought out in the above, arises from the fact that capacity is a thing of three dimensions, while weight has four. Mass, being for the same density proportional to the volume, has, in kind, only three dimensions; but weight has four, because it is mass multiplied by a new factor, gravity, which is not the same on our Mars as on the earth. Some extremely curious consequences have their origin in this fact.

Megamicros, as we shall call our man of the earth transported in his sleep to the new Mars, wakes up, opens his eyes, and finds himself in bed in his room. All the things in it are familiar to him—the furniture, clothes, books, and wares are just where he had left them overnight. He does not suspect the trick that has been played on him. He stretches himself, throws up his arms, leaps from his bed, goes to the washstand, lifts the pitcher, puts on his clothes—and is greatly surprised.

All these actions are of a common character, and consist in raising masses to a certain height. His water pitcher, for instance, holds two litres, new measure. On the earth these two litres, representing two kilogrammes, require a certain effort to be raised, say, to the height of thirty centimetres. But on Mars these two litres weigh only two Martian kilogrammes, or sixteen times less in earthly weight. Further, he does not have to lift them to a height of thirty centimetres, but of only fifteen centimetres, his size being diminished one half; so that the work to be performed is reduced to one thirty-second. On the other hand, his strength, which is proportioned to the volume or the mass of his muscles, is only reduced to one eighth. Consequently, the effort he is required to make is four times less. His water pitcher seems extremely light; so do his clothes. He probably remarked the same thing when he threw up his arms and jumped from his bed, but simply thought he was in unusually good spirits.

If he is in the habit of practicing in gymnastics, and if, on the earth, he raised weights of fifty kilogrammes above his head, he is no little astonished to see that he can now play with weights four times as heavy, or of two hundred kilogrammes.

He prepares to go out. He walks across the length and breadth of his room. There is nothing unusual. The room is smaller, indeed, but his steps are correspondingly shorter. He goes downstairs. He feels again a wonderful lightness and spring. He hardly has to touch the steps. When he goes upstairs his astonishment increases, if that is possible, for he can go up four steps at a time. His muscular energy, it is true, is reduced in proportion to his volume, or to one eighth, but his weight is reduced to a sixteenth, and he only has to lift it half as high.

If, feeling so spry, he thinks he will play a little, he is again surprised to find that while he could formerly leap only to the height of his hips, he can now jump twice as high as his head. If the Eiffel Tower is near by, and he climbs it, he gets to the top four times as quickly as formerly. If he lives in Savoy and climbs Mont Blanc, he feels only one fourth the fatigue of the olden time, and will be very apt to think that somebody has given him a very full dose of some invigorating extract while he was asleep. He is no less astonished when he finds how little danger there is in falling. His child falls down a whole story without being hurt, and he drops fragile things, his water pitcher, for example, without their breaking.

In the same way, but inversely, the inhabitant of Mars, transplanted to the earth, would feel four times as heavy: his leaps would be only a quarter as high; the steps, going up and down stairs, would be four times too high, although they would look the same as ever. Any climb, not to speak of the Eiffel Tower or of Mont Blanc, would take away his breath; and he would be ready to think he had all at once become decrepit.

Fairy stories, and such humorists as Swift and Voltaire, have made us familiar with the idea that there may be cities of dwarfs and of giants copied exactly from ours; and we do not perceive, at first sight, why they should not have their Paris, with the Louvre, boulevards, and hotels, built after earthly models. We could easily fancy that if Gulliver, arriving at Lilliput or Brobdingnag, had become smaller or larger, according to the measure of his hosts, he would not have remarked the diminutiveness of Lilliput and the Lilliputians, or the great size of Brobdingnag, and the Brobdingnagians. This fancy is the more natural at first sight because we have invented the art of drawing and other arts relating to it, and the microscope and photography show us every day considerable enlargements and diminutions without alteration of shapes.

It is, however, not consistent with the most incontestable results of science. The cat is not an exact reduction of the tiger, or the Lilliputian of the Brobdingnagian, any more than a small crystal of alum is a reduction of a large crystal—although one regular octahedron may be the exact image of another octahedron. For if they were, there would no longer be a question of atoms, or molecules, or cells. From the geometrical point of view the cell, the molecule, and the atom are infinitely divisible universes, and therefore capable of containing all imaginable figures within their limits; while from the chemical and physiological point of view they are absolute quantities not capable of reduction in their kind.

Now let us see if a Martian house can be constructed wholly on the plan of an earthly house—that is, if it can be made to present the

same proportions in all its parts. The cube of the construction and the cubic dimensions of the rooms, as well as the number of windows and their superficial proportions, might indeed be the same; but we will consider here the details of construction in view of the materials used. Let us reduce the problem to its simplest expression: a beam on two supports in a condition to bear the weight of a man. Let P be this weight; l , b , and h , the length of the beam between the points of support, its breadth, and thickness; and R , the resistance of the wood. According to a well-known formula, we have: $P = \frac{2Rbh^2}{3l}$

which means that the weight that can be supported increases directly in proportion to the resistance of the wood, the breadth of the beam, and the square of its thickness, and inversely as the distance between the supports.

Since on Mars, according to the data of the problem, R suffers no change, while b , h , and l become $\frac{b}{2}$, $\frac{h}{2}$, and $\frac{l}{2}$, we see that the weight which the geometrically reduced apparatus can support will be equal to $\frac{P}{4}$. We have just seen that the weight of a Martian is $\frac{P}{16}$. Consequently, the apparatus will be four times as solid as necessary. The Martians could use joists and planks proportionately only half as thick or one quarter as broad, or with supports four times as far apart, or any other combination that would reduce the second member of the equation to one sixteenth.

From what we have said of the lightness of the Martians, it would appear that their division walls and fences would have to be relatively four times, absolutely twice as high as with us.

Now, suppose Megamicros preparing to continue on Mars some work he had begun on the earth. He has a bench, planks, nails, and a hammer. His hammer is of seven eighths less volume and mass, and its weight is reduced to one sixteenth. Himself smaller in size, he can no longer lift the instrument to the same height, so that on a final analysis the living force of the hammer reduced in weight is only one thirty-second. The nail is only half as long, and of only one fourth section; so that, supposing the same rigidity, he meets only one eighth of the resistance in driving it into the board. Megamicros then finds that his hammer is four times too light, and can not understand what makes it so.

If the real Martians have passed, like us, through a stone age and come to an iron age, they have had to work with implements relatively four times larger than ours, and are now using hammers of corresponding dimensions.

To return to our imaginary Martians. It may be objected that

the mass of the hammer being eight times less, and the muscular force being no more than eight times less, the velocity impressed upon the hammer will not be half, but equal. The objection is well founded; but then the phenomenon of the fall of the hammer will not be the same as it would be on the earth. An observer situated in the common center of the two suns would see the Martian's hammer drop twice as fast as the terrestrial's. Or the objection might take another form. The velocity of the hammer may remain proportional, but the muscular exhaustion will be four times less, so that the workman can quadruple the number of his blows. In this case the temporal phenomenon, if I may call it that, will be changed. At any rate, if he does not multiply his blows, the nail will not be driven in in the same way. To whichever side we turn, we fall into the same definitive conclusion.

We further remark that the Martians can lift loads four times as heavy as ours: first, because they do not have to carry them so high; and, secondly, because the weight is only half as much. Thus the unfortunate people who built the pyramids on Mars would require only a quarter of the time. Consequently, Megamicros will see all tasks that consist in raising weights performed four times as rapidly. If he builds a house, it will be under roof before he could have got it aboveground on the earth. Life thus passes more rapidly on Mars than on the earth; and yet we can not think of diminishing the length of the days, for then we would increase the number in the year to fourteen hundred and sixty; for we have supposed the new Martian year to be of the same length as that of the earth.

Megamicros, who has learned on the earth to reckon by terrestrial measures, will have a new set to deal with when he is transported to the new Mars. Some may say that he will experience no difficulty in this. They are mistaken.

To speak first of measures of length and surface: If Megamicros required six square metres of cloth to make himself a complete suit of clothes when he was on the earth, he will need no more on Mars, because the surface of his body which he has to cover is diminished in the same proportion as that of the square metre, or as four to one. But as the sun sends him no more heat there than our sun does to us, the goods he will select must be at least as warm as on the earth. No reduction, therefore, is possible in their thickness. Hence, if he himself makes the goods he requires, if his wife knits his stockings and his vests, they will be surprised at the amount of labor they will have to expend, and the quantity of materials they will have to use for the same purpose. With a skein of a hundred metres of yarn, working with a double thread, they will not make more than half of

what they expect to. It will be as if their metre, already shortened one half, were reduced another half. Hence the acre they may devote to the cultivation of flax or hemp or cotton will fall far short of furnishing them as many shirts.

With respect to measures of capacity and weight: On the earth Megamicros quenched his thirst with two litres of wine. These two litres restored to him the quantity of liquid which he lost by transpiration and excretion. Without speaking of excretions, the Martian man will lose perceptibly more by evaporation alone than he did on the earth; for while his mass is reduced to one eighth, his surface is only reduced to one fourth. He will, therefore, lose twice as much by transpiration as he did before, and a litre of wine will not seem to contain more than half the same sum of satisfaction. For a like reason, a kilogramme of bread will not appease hunger in the same measure as on the earth. For food, besides furnishing energy to the muscles, serves, by repairing the loss of caloric, to maintain the animal heat. The cooling surface of the body is twice as great in proportion to the mass; the kilogramme of bread will, therefore, not procure the same sum of muscular energy. We know, as a fact, that small animals have to eat and drink relatively more than large animals.

Megamicros will feel a change of temperature on Mars more than when he was on the earth. He gets cool and is warmed again in less time, when all other things are equal. If a cloud passes over the sun, he will immediately feel a depression of the temperature of his skin. It is a very sensitive thermometer. Two thermometers, geometrically alike, do not act in the same manner. There is no synchronism in their movements. All such disagreements arise from the fact that surfaces do not diminish in the same proportion as volumes.

The problem becomes more and more complicated as we address ourselves to more delicate phenomena. Muscular energy is due to the burning by oxygen of the carbon contained in the blood. This combustion is effected on the surface of the lungs. The quantity of blood of a Martian is eight times less than that of a being of the earth. But while the thoracic cage is diminished in the proportion of eight to one, the pulmonary surface is so only in the proportion of four to one. The combustion is therefore more complete with the Martian than with the man of the earth. Consequently his muscular energy, the effects of which were already so striking in consequence of the reduction of weight, will be still more marked by virtue of this circumstance. On the other hand, combustion being more active, the kilogramme of bread, which we have already found not enough, becomes still more insufficient—a new pertur-

bation. Another consequence: we have just said that the cube of the houses *might* be, on Mars, proportional to the cube of our houses. But if boards of health should proceed there according to the same principles as with us, they would have to order larger and higher rooms. It may be suggested that the atmosphere of Mars is less dense than ours, because it is not so thick, and gravity is less there. Here is, indeed, a great difficulty, which, fortunately, it is not necessary to resolve, because the law of Laplace supposes that the density is the same at homologous points. On the surface of Mars the air, then, has the same density and the same composition as on the surface of the earth. But will the inspirations be as long? The diaphragm of the Martians has not the same work to do as that of the earth people. It is true that it is only half as thick, but its surface is only a quarter, and the amplitude of its movement only one half. But we must not discuss the rhythm of the diaphragm or the beatings of the heart unless we shorten the days and increase the number in a year.

We see that whichever way we turn we can not for an instant entertain the illusion that an earth-man could be put on Mars without knowing it.

We shall fall into more and more inextricable difficulties if we go further into the detail of the respiratory and circulatory phenomena. The capillary vessels of the Martians are four times narrower in section. The heart, then, would have to use more force to make the blood circulate; yet the heart is much weaker, with thinner walls, smaller cavities, etc. Even if the Martians resemble men externally, their whole interior organization must be decidedly very different.

The persistency will be remarked with which the number four recurs in these calculations. This is because weight is reduced one half on Mars, and also, because of the reduction in their linear dimensions, the Martians have to exercise only half the effort to produce the same apparent effect. It might be concluded from this that if the universe was reduced geometrically in the proportion of three or of five to one, we should immediately find ourselves nine or twenty-five times lighter, stronger, and more active. By an inverse conclusion, if we could imagine the case for a few moments, we should have to be three or five times larger. Hence the paradoxical conclusion that the smaller the world is, the larger its people should be; so that, if the smallest asteroids are inhabited by men, the inhabitants would be more important in size than their planet, and might, in case of extremity, take it in their arms. On the other hand, the larger the planetary mass, the smaller the men should be, if their muscular sensations are comparable to ours.

If we have brothers living on Jupiter, they must be about the size of ants.

If, indeed, we go down to the bottom of the matter, we shall be forced to admit that there is, in a being capable of observing and discerning, something permanent, fixed, and superior to spatial dimensions, and independent of their variations. This something is the feeling of the required effort, of the executed movement, and the fatigue that follows it. The feeling appertains essentially to every muscle that works under the impulsion of the will. This feeling is neither line, nor surface, nor volume, nor weight. It is the same for small and large animals, for the child and the man, the dwarf and the giant. He who lifts the heaviest weight he can manage fatigues himself always just so much, whether he be weak or strong, fresh and nimble or tired and dull, sturdy or feeble. The ant dragging a straw experiences integrally the same feeling as the porter carrying a sack, or the horse pulling a wagon, if the straw, the sack, and the wagon are proportioned to the strength of the ant, the man, and the horse.

Magamicros, transported to Mars, has retained in himself the inner unity of measure that permits him to estimate masses according to his strength. When on the earth he lifts loads of fifty kilogrammes greatest weight, the equivalent of this weight on Mars is not for him fifty Martian kilogrammes, but two hundred kilogrammes greatest weight. Hence his astonishment. I say, purposely, sometimes weight and sometimes mass. Fundamentally, he estimates weight; but weight represents to him a certain quantity of matter as related to his strength and his requirements. No matter if the kilogramme of Mars is only equivalent to one sixteenth of the kilogramme of the earth. If a Martian kilogramme of meat, bread, or beans represents on Mars the same relative amount of work or pleasure as the earthly kilogramme of meat, bread, or beans does on the earth, it is equivalent, even equal to it; but if Megamicros does not find in it the same quality of restoring strength or producing pleasure, he will think it is different.

Pleasure, pain, and fatigue are not measured by the metre, litre, or kilogramme. The pleasure felt by a grasshopper in eating a blade of grass is not less than that of a cow with the range of a whole pasture. But we know that the grasshopper has a more pressing need of food than the cow, because it is smaller. If, then, by an ideal reduction of proportions, the cow fails to get the same satisfaction out of the meadow, she will not judge its size by sight, but by her stomach.

Let us go still further. None of my readers has thought of raising the objection that while transporting Megamicros to Mars

I have diminished him in other respects but not in intelligence, and that I should have given him only a half, a quarter, or an eighth of judgment. There would be no reason in this. I have received from Biskra a uromastix—a kind of herbivorous lizard, with its tail armed with points. Not having any Algerian plants to feed it, I put it in a field where there were all kinds of wild flowers. The animal found the flowers of the smartweed to its taste. Wishing to vary its diet, and particularly to find something it would eat in winter, I tried to feed it other things; but, though it was docile and ate smartweed, fumitory flowers, and wood violets from the hand, it showed a marked aversion or indifference to clover. One day, in my impatience, not having found any smartweed, I opened its mouth and forced in a clover blossom which it finally swallowed. The next day, to my astonishment, having some clover blossoms in my hand, the animal seized them and devoured them with evident greedy pleasure. It recognized the plant it had been forced to swallow and had found good, though it had despised it before. It had got rid of a prejudice. Would a rhinoceros have acted more rationally? Who would have thought of its large size giving it more intelligence?

A very important conclusion results from our discussion. Laplace's law is true mechanically, within the strict limits in which it is announced. But the psychical consequences Laplace draws from it are fallacies, and the simplest phenomena of elasticity make the fallacy evident. Yet if the law of universal attraction were all we had by which to account for every kind of manifestations, psychical as well as physical, or, in other words, if there were nothing in the universe but material atoms situated at perceptible distances apart, and attracting one another in proportion to their masses and inversely as the squares of their distances, Laplace's conclusion would be impregnable; an observer could not perceive any diminution or augmentation in the universe. But why? Because there would be no longer an observer. As I have demonstrated, the moment there is an observer, he will perceive a change; and if he perceives it, it is undoubtedly because the faculty of observation escapes—with others—the law of universal attraction; because it does not depend solely upon the mass of the atoms and their distance. It is the same with the ant and with the elephant.

A final conclusion is that if all these deductions are exact, real space is different from geometrical space, and the dimensions of the universe are absolute.—*Translated for the Popular Science Monthly from Ciel et Terre.*

THE FIRST THERMOMETERS.

By M. P. DUHEM.

THE thermometer, the Abbé Nollet writes, came for the first time from the hands of a peasant of North Holland. This peasant, whose name was Drebbel, was not, however, in fact, one of those coarse fellows who know of nothing but field work; he seems to have been of a diligent nature, and had apparently some knowledge of the physics of the time. An ingenious inventor as well as an impudent pretender, and boasting that he had discovered perpetual motion, while he made great advances in the art of dyeing cloths, he secured favors from James I; Rodolf II gave him liberal pensions and brought him to his court; and Ferdinand II, who was himself interested in the thermometer, chose him as the tutor for his son.

Drebbel's thermometer—an invention which he may have borrowed from Porta, and in which Galileo doubtless preceded him—was composed of a vertical glass tube ending at the top in a bulb, while the lower end was plunged into a vessel filled with water or some colored liquid. When the bulb was warmed, a part of the air contained within it was driven back into the water and escaped without. When the air became cool again as the temperature around it, the external pressure caused the liquid to rise in the tube, the limit of its ascent being determined by the degree to which the air in the bulb had been heated, and the tension it had acquired.

This hardly practical apparatus was still used in Germany as late as 1621. The members of the *Accademia del Cimento*, with their active interest in all physical progress, soon substituted for it the more convenient instrument which we still use. Contained in a transparent bulb prolonged into a fine tube, a liquid more dilatable than the bulb rose in the tube when it was warmed, and descended when it was cooled. The Florentine Academy, moreover, never let any physical discovery pass without trying to apply it to the healing art. Galileo had hardly recognized the constancy of the time of the oscillations of the pendulum before the pendulum was used to determine the rapidity or the slowness of the pulses of patients. The thermometer, made convenient and portable, became in the hands of the Venetian physiologist Santorio Santori a sensitive and precise indicator of the progress of fever. Santori's writings made the instrument popular, and it was soon common in the enameled shops as the Florence or Sanctorius thermometer.

It is hard to imagine the interest that was excited by the indications of this instrument, which was declared to be "worthy of

Archimedes." Everybody was curious to observe the ascent or descent of the colored spirit in the tube; for, Nollet wrote, "the physician, guided by the thermometer, can labor with more certainty and success; the good citizen is better informed regarding the variations that concern the health of men and the productions of the earth; and the individual who is trying to procure the conveniences of life is informed by it as to what he must do in order to live all the year in a nearly uniform temperature." According to Amontons, Colbert had a project for constructing a large number of thermometers and sending them to different parts of the earth for making observations on seasons and climates, but was obliged to give it up on account of the imperfect character of the spirit thermometer of the time. Different instruments would not agree.

The marking of the degrees on the thermometer stems was not controlled by any fixed rule, and they therefore did not express the same heat or the same cold by the same number of degrees. To remedy this defect, some physicists advised that the lowest point reached in the extreme cold of winter and the highest in summer be marked, and the space between be divided into a hundred equal parts. Such a thermometer would indeed permit its owner to compare the cold and heat of different years; but in communicating his observations to another he would give him data that would have no meaning unless he also sent him the instrument he had used, or one having identical graduations.

The problem was first solved in 1702 by Amontons; and his method, although it has been given up and resumed at intervals, has now become the normal one to which all others are subordinated. It is based upon two observations, both of which are of primary importance. We take two masses of air in two bulbs. Each of these masses is separated from the outer air by a curved tube filled with mercury, forming a manometer. Suppose that at a given temperature one of these masses supports a pressure of one, and the other of two atmospheres. Warm the two masses of air equally, and pour into both manometers enough mercury to maintain invariable the volume occupied by each of them. While the pressure supported by the first mass will increase to a certain amount, that sustained by the other mass will increase doubly. The pressure on the second will always be double that on the first. Thus, when we warm the two masses equally, while keeping invariable the volume of the recipients containing them, a constant relation will be maintained between the pressures supported by them. This is Amontons's first observation.

In the second observation, which can be made with an arbitrarily

graduated thermometer, the temperature of boiling water is found to be invariable. Not only does the thermometer immersed in water keep for any number of hours of boiling the height it had reached when the first bubbles came up, but it ascends to the same point every time it is placed in boiling water. If Amontons had added the proviso that the pressure of the atmosphere should be the same in all the experiments, which we know now is indispensable, he would have been rigorously exact.

When we take a bulb of air connected with a manometer, mark carefully the pressure which it sustains when it is plunged into boiling water, and then the pressure at which, under other circumstances, it reaches the same volume, the ratio of that pressure to the former may be regarded as expressing the ratio between the temperature to which the air was raised under the latter condition to the fixed temperature of boiling water. This ratio will be the same, whatever thermometer, constructed in the same way, we may use. In this way we have a sure means of obtaining instruments that can be compared with one another.

Amontons proposed for a thermometer, as Drebbel did, a mass of air maintained at a constant volume under a variable pressure. The rule by which he attached a certain degree of temperature to each degree of heat and cold, or a larger number for more intense heat and a smaller for cold, is the same rule to which Desormes and Clément on the one hand, and Laplace on the other, returned a century afterward; and is the rule proposed in the works of Sadi Carnot, Clausius, and Lord Kelvin as the measure of the absolute temperature.

The profound reasons which cause us to prefer the definition of temperature proposed by Amontons to every other could not be divined at the beginning of the eighteenth century. The large size and inconvenient shape of Amontons's instrument, and the necessity of taking account of the variations of atmospheric pressure in interpreting its indications, prevented its general adoption; and the Florence thermometer was still preferred. Spirit thermometers, that could be compared with one another, were in demand. Réaumur furnished them.

Réaumur observed, in 1730, that a thermometer placed in freezing water went down to a certain degree, and remained fixed there as long as the water was not wholly solidified. The temperature of water in process of congelation was therefore always the same, and fixed. As physics has advanced, some corrections have been made in this law, and causes have been discovered that make the point of congelation of water vary; and physicists have been induced, in view of it, to take as their fixed temperature, instead of the freez-

ing point of water, the melting point of it. But neither these corrections nor the incidental recognition by the Florentine Academicians of the invariability of the melting point of ice diminish the importance of Réaumur's discovery.

Having discovered a fixed temperature, Réaumur deduced a way of making spirit thermometers that could be compared with one another. If we plunge a glass bulb prolonged into a fine tube and filled with spirit into freezing water, and draw a line marked zero flush with the top of the liquid, then determine the volume occupied by the liquid under these conditions; if we divide the tube into portions, the interior capacity of which represents at the temperature of the freezing of water aliquot parts of that volume—hundredths, for example—and number these divisions from the line marked zero; then if, in an experiment, we see the spirit rise to the level of the division marked five, we know that the spirit in the glass has suffered an apparent dilatation of five hundredths between the freezing temperature of water and the temperature of the experiment. If we always take care to use spirit of the same quality—and Réaumur prescribed minute rules on this subject—and if we neglect the changes which the variable nature of the glass will introduce into the law of dilatation of the thermometric receptacle, we will obtain instruments of a kind that will always mark the same degree when they are equally heated or cooled.

For two instruments constructed according to the laws laid down by Réaumur to be rigorously comparable, it was essential that they be made of the same glass and filled with the same liquid. If the glass of which they are made has not exactly the same composition and tempering in both, and the alcohol has not the same degree of concentration, they will not agree. In order to diminish these variations, it is convenient to fix all thermometers, whatever they may be made of, so that they shall give the same indications for two fixed temperatures. The point reached by the liquid at the lower of these temperatures is marked on the instrument, and then it is raised to the higher temperature, and the point which it reaches then is marked. The interval is then divided into parts having the same interior volume, and the division is carried out beyond the fixed points. In such thermometers the liquid will stand at the same mark for an equal degree of heat, notwithstanding slight inequalities in the glass and the fluid.

It was some time before the two fixed temperatures at which the thermometric scale should be marked were determined upon. Dalencé, in 1688, took a mixture of water and ice for the zero, and the melting point of butter as the upper point. Renaldini, in 1694, recommended a mixture of water and ice and the boiling point of

water, but his process was not applicable to the alcohol thermometers then in use, for the vapor of alcohol has a tension at the boiling point of water which would burst the reservoirs of the instruments. And Renaldini's method could not be adopted till after Musschenbroeck had introduced the use of mercury. In 1729, Delisle chose as graduating points the temperature of ice-water and the almost invariable temperature of the cellars of the Observatory at Paris.

About 1714 a skillful instrument-maker of Dantsic, Daniel Gabriel Fahrenheit, furnished chemists with alcohol thermometers which he replaced in 1720 with mercury thermometers, the indications given by which all agreed with one another. According to the chemist Woulfe, he boasted that he could make a thermometer that would agree with those he had already made in any place, and without seeing any of the instruments that had already gone out of his hands; but he would not divulge the process by which he had been able to obtain such an agreement. This process, in establishing which he had been aided by the advice of the astronomer Roemer, was nothing else than the method devised by Dalencé; but Fahrenheit took for his zero the temperature of a mixture of ice and muriate of ammonia (chloride of ammonium)—which, he thought, was the greatest cold that could be obtained—and for his higher degree the temperature of the human body.

Finally, in 1742, the Swede, Andrew Celsius, proposed to restore the method of Renaldini, and divide into a hundred degrees the interval which the mercury in the thermometer would traverse between the temperature of melting ice and that of boiling water. He marked the lower temperature 100, and the higher 0. Linnæus, reversing this order, gave the mercury thermometer (centigrade) the form under which it is now known.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

CARL VOGT, his son William relates, thought little of honorary titles and decorations, and generally refused them when offered him; while he highly appreciated sincere and spontaneous tributes to the value of anything he had done. Finally, his friends convinced him that a traveler who could exhibit some badge of knighthood might receive better treatment at the customhouses than one who had none, and he accepted the last cross of the French Legion of Honor that Gambetta conferred. At dinner one evening in Berlin, his hostess, after proudly exhibiting her orders, asked him about his. He had none, he said, except the cross that Gambetta gave him. Perceiving that this was not well received, he be-thought himself, and added: "Oh, I forgot. I wear, too, the blue and white badge of the Society of Cooks of Munich, and am very proud of it, because they gave it to me of their own accord after I had translated Brillat-Savarin."

SKETCH OF SIR JOSEPH LISTER.

THE merits of Lord Lister's work in the institution of antiseptic and aseptic surgery are recognized as of the very highest value to the human race, and all nations are delighted to do him honor for it. The general feeling is summarized in an English chronicle which says that for it "he is justly regarded as one of the world's greatest benefactors." Prof. H. Tillmanns, in an estimate of him published in *Nature's* "Scientific Worthies," speaks of it as his "immortal life-work," and as constituting "the greatest advance which surgery has ever made."

Sir Joseph Lister received by descent the tastes and aptitudes which have enabled him to reach his present eminence. His father, Joseph Jackson Lister, though a man in business, found time to devote to science, was a Fellow of the Royal Society, devised an improvement in the microscope, concerning which he published a paper on achromatic glasses in the *Philosophical Transactions*; contributed other papers to that publication; and, with Dr. Hodgkin, first described the tendency of the red corpuscles of the blood to arrange themselves in rouleaux.

JOSEPH LISTER was born at Upton in Essex, England, in 1827; was taught at a private school of the Society of Friends in Tottenham; was graduated Bachelor of Arts at the University of London in 1847; and studied medicine at University College, London, where his attention was specially directed to physiology. Having been graduated in medicine from the University of London in 1852, and enjoyed a creditable career at the hospital, he went to Edinburgh, where he became associated with the late Professor Syme, whose daughter he married, and was his house surgeon for a time. He was appointed assistant surgeon to the Royal Infirmary, and extra-academical lecturer on surgery, in which capacities he added to his reputation. In 1860 he was appointed regius professor of surgery in the University of Glasgow. During all this period he published many papers, the general trend of which seemed to direct itself toward the field on which he has won his supreme fame. His first papers, published in 1853, while he was still a student, were on the muscular tissue of the skin and the contractile tissue of the iris. Of papers published in Edinburgh between 1857 and 1860, those dealing with the subjects of inflammation and the coagulation of the blood are mentioned as having been the most important. The expressions of his views on this last subject were one of the features of his Croonian Lecture of 1862, which, *Nature* says, "excited great interest, upsetting as it did most of the accepted

notions, and forming the groundwork of much of our modern teaching on the subject."

Lister's work in connection with antiseptic surgery began while he was at Glasgow. Some of the surgical wards of the Royal Infirmary there were distinguished for their unhealthiness, in which they were hardly surpassed in the kingdom. The method he employed then was very crude and rudimentary, but he applied it with the result, as he was able to believe he could say without exaggeration, that those particular wards became "the healthiest in the world; while other wards, separated from mine only by a passage a few feet broad, where former modes of treatment were for a while continued, retained their former insalubrity." Equally striking changes were afterward witnessed in other institutions, as in the Allgemeines Krankenhaus in Munich, the director of which, Professor von Nussbaum, sent his assistant to Edinburgh, whither Lister had removed, to learn the details of the antiseptic system as it was then practiced. From the day the system was introduced into the Krankenhaus, hospital gangrene, which had infected eighty per cent of the wounds treated, disappeared entirely, and pyæmia and erysipelas soon followed it. "But it was by no means only in removing the unhealthiness of hospitals that the antiseptic system showed its benefits. Inflammation being suppressed, with attendant pain, fever, and wasting discharge, the sufferings of the patient were, of course, immensely lessened; rapid primary union being now the rule, convalescence was correspondingly curtailed; while as regards safety and the essential nature, it became a matter of indifference whether the wound had clean-cut surfaces which could be closely approximated, or whether the injury inflicted had been such as to cause destruction of tissue. And operations which had been regarded from time immemorial as unjustifiable were adopted with complete safety."

Lister relates in his British Association address that he had been long impressed with the greatness of the evil of putrefaction in surgery, and had done his best to mitigate it by the use of various deodorant lotions. It does not appear to have been quite clear as yet what the cause of it was. Liebig's theory that it was an effect of oxygen was still current; and if this were the fact, the prevention altogether seemed to be hopeless. "But when Pasteur had shown that putrefaction was a fermentation caused by the growth of microbes, and that these could not arise *de novo* in the decomposable substance, the problem assumed a more hopeful aspect. If the wound could be treated with some substance which, without doing too serious mischief to the human tissues, would kill the microbes already contained in it and prevent the future access of

others in the living state, putrefaction might be prevented, however freely the air with its oxygen might enter." He had heard of carbolic acid as having a remarkable deodorizing effect on sewage, and, having obtained a quantity, determined to try it in compound fractures. "Applying it undiluted to the wound, with an arrangement for its occasional renewal, I had the joy of seeing those formidable injuries follow the same safe and tranquil course as simple fractures in which the skin remains unbroken." The earliest antiseptic dressings were very cumbrous. At first an antiseptic crust of blood and pure carbolic acid was formed, and protected by a sheet of block tin; next carbolic acid and oil were used; then a layer of putty made with carbolic acid was applied; after this, a plaster made of shellac and carbolic acid. This was superseded by the typical dressing, or the Lister bandage, in which a layer of waterproof silk, the "protective," was placed over the wound to protect it from the direct action of the irritant substance in the antiseptic dressing materials; over this came some eight or more layers of carbolized gauze or muslin, with a sheet of gutta-percha tissue between the outer two of these. The whole was then bound round with carbolized gauze, so as to effect as far as possible an air-tight inclosure of the wound. With this was associated a spraying of carbolic acid when the wound was being treated or the bandages were being applied or changed, in order to prevent the access of microbes in the air. As the structure of the bandage became gradually simpler and more convenient, so the system itself was improved and simplified till, while the principle remains the same, the mode of applying it has become very different from what it was at first. The most important of these improvements seems to have been suggested in 1871 or 1872 by a paper of Dr. Burdon Sanderson's showing that bacteria, unlike the spores of fungi, are deprived of vitality by mere desiccation at an ordinary temperature, so that, while a drop of water from ordinary sources or the contact of a moist surface is sure to lead to bacteric development and putrefaction in an organic substance susceptible of that change, the access of dust from exposure to the atmosphere merely induces the growth of fungi and comparatively insignificant chemical alteration. "If this were true," Lister said, in a communication to the Royal Society of Edinburgh made in April, 1873, "it would be needless to provide an antiseptic atmosphere in carrying out the antiseptic system of treatment; and all that would be requisite in the performance of a surgical operation would be to have the skin of the part about to be operated upon treated once for all with an efficient antiseptic, while the hands of the surgeon and his assistants and also his instruments were similarly purified; a dressing being afterward used to guard

against the subsequent access of septic material. Thus the use of the spray might be dispensed with, and no one would rejoice more than myself in getting rid of that complication." The suggestion thus indicated was not acted upon in surgical practice till after much testing and experiment, by which Lister was led to conclude, definitely, that it was the grosser forms of septic mischief, rather than microbes in the attenuated condition in which they exist in the atmosphere, that were to be dreaded in surgical practice. At the London Medical Congress, in 1881, he hinted that it might turn out possible to disregard altogether the atmospheric dust, but he still did not venture as yet to try this upon his patients.

At the Berlin Congress, in 1890, he brought forward what he regarded as absolute demonstration of the harmlessness of the atmospheric dust in surgical operations and of the sufficiency of methods in which irritation of the wound by strong antiseptics was avoided.

Under the method now in use, as described by Prof. H. Tillmanns in Nature's "Scientific Worthies," "operations are performed with almost painfully precise sterilization of every object or instrument employed, as Lister first taught us to do, while at the same time we limit as far as possible the action of irritant antiseptics, such as carbolic acid, and even advantageously use none at all, operating with as little fluid as possible. So far as it may be necessary, the fluid now employed is a sterilized solution of common salt, or else sterilized water. In the place, then, of carrying out our operations under the former strictly antiseptic precautions, we now operate aseptically. But the fundamental idea on which Lister's antiseptic method was based has remained unchanged, and will always be the same. . . . The operational area on the patient is carefully disinfected in accordance with Lister's instructions, and is surrounded with aseptic linen compresses sterilized in steam at from 100° to 130° C. We employ exact and definite methods to free our hands from microbes, and the instruments are sterilized by boiling in one-per-cent solution of sodium carbonate. All bandages and the outer garments we wear are made aseptic by prolonged exposure to steam at from 100° to 130° C., in a specially constructed apparatus; and so, also, in respect to all else. Steam thus provides us nowadays with non-irritant bandaging materials free from germs with even greater certainty than did their earliest impregnation with antiseptic substances. . . . Instead of sponges we now use muslin absorbents sterilized by steam, and these, like every other fragment of bandaging material, are burned after being used but once. In short, the technics of modern surgery is based on Lister's method,

and takes for its watchword, 'asepsis without the use of antiseptics.' Antisepsis has given place to asepsis, but the latter is just as surely based on the ground first broken by Lister." The earlier results that followed the application of Lister's methods are described as having been simply astounding, and the feelings they inspired as like those that follow "a mighty victory finally won after prolonged and grievous defeats." In those hospitals where septicæmia had been most certain, the best results were obtained, and wound fevers came to be no longer dreaded. Equally good and certain results attend the treatment carried out under aseptic precautions. Surgery now hardly hesitates at anything, but fearlessly deals with every organ of the human body. Operations that were approached with extreme hesitation, or were put off till the last possible moment, or were not ventured upon at all, are now undertaken fearlessly, and with the certainty that no harm will come in them from putrefaction. "It now celebrates its greatest triumph in dealing with the skull and cranial cavity, with the brain, spinal column and spinal canal, with the thoracic and abdominal viscera, with bones and joints, with tendons and nerves; and patients are not afraid to trust themselves with the surgeons in the most delicate operations, and such as once would have been certainly fatal.

Lister's views were much controverted at first, and it was a long time before they were generally accepted in England. Then, when the application of the system had been modified in the light of additional study and experiment, and it became aseptic instead of antiseptic, they said that he had shifted his ground. This was not so, for the fundamental principle on which it has rested has all been the same, and the differences in application are only of detail; and, as we have already seen, he was almost from the beginning considering whether he could not dispense with the spraying, having deduced the conclusion that it was not indispensable long before he ventured to omit it.

Professor Tillmanns claims that it was in Germany first, rather than in England, that Lister's scientific works met with their earliest recognition and general appreciation; tells how he, like other German surgeons, sought out "the founder of modern surgery" in his London hospital, and, "filled with gratitude," laid his homage at his feet; and gleefully speaks of the ovation which the professors and students offered him a few years ago at Leipsic.

In 1869 Lister was appointed to the chair of clinical surgery in the University of Edinburgh, where he succeeded Dr. Syme, his father-in-law; where large and enthusiastic classes listened to his lectures; whence the reputation of his clinic extended through the

world; and where he continued the elaboration of his system, introducing some of the simplifications we have already described. In 1877 he was appointed to succeed Sir William Ferguson as professor of clinical surgery at King's College, London. He held this position till 1893. In 1876 he was appointed by the Privy Council to the General Medical Council for Scotland.

Lister's later writings, consisting mainly of articles scattered through various periodicals, have been devoted chiefly to subjects connected with the germ theory of disease, and include investigations into the processes of fermentation and the life history of certain micro-organisms, and papers on the bearing of bacteriology upon surgical treatment.

The discovery of the antiseptic system is a matter of such transcendent importance as almost to obscure the many other improvements and modifications which Lister introduced into surgical practice. He devised a way of bloodless amputation by simply elevating the limb, so that an emptying of it was effected both mechanically and by means of a contraction of the arteries consequent upon the altered position. He invented a tourniquet for compressing the abdominal aorta, whereby the hæmorrhage was diminished in operations in the neighborhood of the hip joint. He introduced the amputation called by his name, and an operation for excision of the wrist. He was the first to undertake osteotomy for the purpose of rectifying deformity of the limbs. He advocated a more complete method than had been practiced of operating on cancer of the breast, and introduced the treatment of fractures of the patella and other bones communicating with joints by means of open incisions and wiring.

The medal of the Royal Society was conferred on Dr. Lister in 1880; and in 1881 the prize of the French Academy of Sciences was awarded to him for his observations and discoveries in the application of the antiseptic treatment in surgery. In 1883 he was made a baronet on the recommendation of Mr. Gladstone. In 1896 he was president of the British Association, and in his presidential address gave an extremely modest narrative of his experiments and the development of his aseptic method. He has received numerous honorary degrees and honors from colleges and learned societies. He succeeded Lord Kelvin as president of the Royal Society in 1895; was raised to the peerage as Lord Kinnear in 1897; and is surgeon extraordinary to the Queen.

Correspondence.

PROFESSOR DRUMMOND'S MISTAKE.

Editor Popular Science Monthly :

DEAR SIR: The ordinary reader, having neither the time nor the facilities for verifying much of what he reads, must needs take a great deal for granted.

And this habit of childlike confidence applies especially to the numerous quotations he encounters, for he very naturally assumes that no writer of any pretensions and standing can be so utterly lost to all that is fair and honorable as to deliberately misquote and misrepresent a fellow-craftsman and serve him up to undeserved ridicule. Yet experience proves that it is not prudent to rely too implicitly upon the infallibility of any writer, for it is sometimes apparent that even those who pose as the most strenuous sticklers for the truth when it comes to quoting from the works of rival contemporaries are not always so successful in resisting a natural propensity to lie as was the poet Schiller.

Criminal carelessness also accounts for many of these garbled quotations, and we find too that in some instances the offender has taken them second hand, and is himself the victim of misplaced confidence, as in the case of Professor Drummond, whose high character constrains us to believe that it was because of his too ready reliance upon the accuracy and integrity of a certain writer in the *Contemporary Review* that he committed the flagrant injustice of incorporating in his admirable book, the *Ascent of Man*, not only a palpably garbled version of Herbert Spencer's definition of evolution, but also the sarcastic comments of this unprincipled critic upon his own miserable perversion of it.

But while granting full absolution to the erring professor, we can not but wonder nevertheless that he should have been so easily betrayed into this grave injustice, when, had he carefully read the very paragraph from Spencer to which he refers the reader, he must have discovered how false and misleading was this citation from the *Review*, as will plainly appear from the following comparison:

On page 5 of the third edition of the *Ascent of Man* (James Potts, publisher, 1894) we read: "Mr. Herbert Spencer's famous definition of evolution, as a change from an indefinite coherent heterogeneity to a definite coherent heterogeneity through continuous differentiations and integrations," etc., while the version as given on page 65 of Spencer's *Data of Ethics*, to which Mr. Drummond refers us, is really as follows: "Taking the evolution point of view, and remembering that while an aggregate evolves not only the

matter composing it, but also the motion of that matter passes from an indefinite incoherent homo-geneity to a definite coherent heterogeneity," etc.

It will be observed how effectually the substitution of the underscored syllables clarifies the alleged version and redeems it from utter and idiotic unintelligibility.

Even when correctly stated we may have differing opinions as to the clearness, consistency, and scientific value of Mr. Spencer's "famous definition," but we can not differ as to his right to have it quoted correctly, and doubtless Professor Drummond would have so quoted it but for his overweening confidence in the careless or mendacious reviewer before alluded to.

JAMES W. DONALDSON.

ELLENVILLE, N. Y., November 6, 1897.

A PROTEST.

Editor Popular Science Monthly :

SIR: In an article entitled *The Foreign Element in American Civilization*, published in the *Popular Science Monthly* for January, the writer, referring to the Irish, states, "He is first an Irishman, then an American, and such only so far as it is an America of the green flag." To prove his proposition he refers to the great pilgrimage to Ireland this summer to celebrate the centenary of 1798.

It has been conceded by all impartial writers that of all nationalities there is none that more readily or more naturally assimilates as an American citizen or forms a more integral part of the great republic than the Irishman. Every true American feels, knows, and enthusiastically declares that of all human emotions there is none more powerful as an incentive to grand and noble deeds than that which brings us back to the spot where we first received a mother's smile, a father's blessing, to the cradle of our childhood, the playground of our boyhood, the theater of our manhood. I appeal to every battlefield of the Revolution, from Stony Point to Yorktown, upon which Irish blood flowed freely, and the Irish sunburst waved side by side with the red, white, and blue. I appeal to Wayne's bayonets, Knox's artillery, and Morgan's rifles.

"New force we want to stem the brunt,
So bring the Irish to the front."

They were brought to the front at Stony Point, Monmouth, Bennington, King's Mountain, and the Cowpens. I appeal to the volcanic heights, the towers, the gates, the cactus-circled fortresses of Mexico. I appeal to the bloody slopes of Malvern Hill, the

crimson stone wall of Fredericksburg, the deadly swamps of the Chickahominy, the thickets of the Wilderness, the purple waters of Antietam, and the bloody angle at Gettysburg. I appeal to the hundred fields now billowed with Irish graves to prove that never man fought more devotedly or more heroically for the inviolability of the Stars and Stripes and the indissolubility of the Union than did the men who cherished in their hearts the memories and love of their native land.

Their fame will live as long as the Great Republic herself—yea, while mountains raise their summits to the sky and rivers journey onward to the sea—

"While Fame her record keeps,
Or Honor points the hallowed spot
Where Valor proudly sleeps."

DR. J. C. O'CONNELL.

WASHINGTON, D. C., February 1, 1898.

A CORRECTION.

Editor Popular Science Monthly :

DEAR SIR: In the Sketch of Carl Vogt in the last November number of the Popular Science Monthly, Prof. Charles Follen, of Harvard University (1825-1835), was referred to as "implicated in the assassination of Kotzebue." This statement, unexplained, is misleading and unjust. Two months after the assassination Carl Follenius, at the time teaching in Jena, was brought to trial by a hostile government as an accomplice, but was fully acquitted. In those disturbed times—1819—this vague charge was easily made, but should not now be allowed to pursue unchallenged the memory of so estimable a man as Dr. Follen, with whose entire life it was inconsistent.

Will you be so kind as to insert this

statement in an early number of your magazine?

Very truly yours,
CHARLES W. ELIOT.

HARVARD UNIVERSITY, CAMBRIDGE,
January 6, 1898.

HAD space permitted, the writer of the sketch of Carl Vogt would have more fully set forth the real nature of the incident referred to, which the Vogt family evidently considered anything but a discredit. He did not regard it as derogatory to Professor Follen's character, and mentioned it simply as tending to establish a bond between Carl Vogt and the United States, and as showing that Vogt's revolutionary sympathies were an affair of the blood. We are glad to publish President Eliot's letter, and the fact that Follenius was acquitted on his trial, which is not mentioned in William Vogt's life of his father, *La Vie d'un Homme—Carl Vogt*, whence the material for the sketch was derived. That work opens with a pen picture of two young students—Carl Sand and Carl Follenius—casting dice, at an inn between Erfurt and Jena, as to which should slay Kotzebue. The lot fell to Sand. William Vogt further records that Follenius, "they say," when Sand confided his purpose to him, abhorring murder, tried to dissuade him from carrying it out, as he did, too, after the casting; but, finding Sand was immovable, he "demanded for himself, Follenius, the perilous honor of striking down the monster" (*réclama pour lui, Follenius, le périlleux honneur d'abattre le monstre*); also that Follenius attended the execution of Sand, and embraced him on the scaffold. He was afterward banished from Germany and took refuge in Switzerland, where he was professor of civil law at Basle, till the monarchs of the Holy Alliance demanded his extradition. He then went to Paris on the invitation of Lafayette, and thence came to America.—EDITOR.

Editor's Table.

THE CLAIMS OF SCIENCE.

A PROFESSOR of biology in one of our leading universities has lately been discussing the question how far an acceptance of the doctrine of evolution is compatible with religious orthodoxy of the evangelical type. The answer he gives is on the whole comforting to those who desire to recognize new truth without breaking entirely away from old and cherished opinions. He acknowledges

that science has rectified our understanding of the word "create," and so far thrown new light upon the interpretation of a Hebrew term. We are ready to admit that a term in present use in our own language may undergo a change of meaning, for this is a process which we see in constant operation; but it seems a little arbitrary to say that a word in a virtually extinct language must be taken in a new sense simply because

the new sense better fits lately discovered facts. The point, however, is not one which we care to discuss at length; and if the learned professor says that the Hebrew lexicon should be revised from time to time, so as to keep it abreast of modern physical science, we see no reason to object. Let the authorities on Semitic philology look to it.

It is admitted by the writer to whom we are referring that evolution compels us to "view types and design in a new light." Types are not to be considered as "artificial models to which all actual cases must more or less closely conform." We must rather look on them as "the generalized results of variations during past generations, the accumulated effects of growth and variations somehow or other acquired in the past and, we know not why, persisting by heredity." They are not, he distinctly says, "a stamp impressed from without." As to the manifestations of design, we must regard them as "dependent on some internal qualities by which organisms became accommodated to the exigencies of their place in the world." The choice is presented to them, we are told, of becoming so accommodated or perishing; some manage the accommodation and some perish. It is needless to say that there is very little left here of the old and venerable doctrine of design, and that in the account above given of type the classical idea is equally attenuated. There is, nevertheless, we are assured, no reason why we should not "regard all these phenomena as illustrating the method of divine creation and government."

Coming down to particular theological doctrines, the writer claims that they may one and all be held consistently with a full acceptance of the evolutionary standpoint; and

here again we have no desire whatever to dispute his contention. What science demands above all things is intellectual sincerity and integrity. Science in its infinite variety interests different minds in many different ways; and he who has the true scientific spirit will, so far as the order of facts in which he is especially interested is concerned, follow to the very best of his ability a rigorous scientific method. In other regions of thought or speculation he may be less exacting as to proof and more disposed to indulge what Bagehot called "the emotion of belief." Science grows by what is done for her in different fields by men who themselves may be widely at variance with one another as regards large sections of their thought. It is therefore unwise for any one to attempt to set up, in the name of science, one scheme of opinion upon all subjects for all classes of minds. We have known, or at least heard of, graceless zealots of materialism who called in question Faraday's claims to be a true man of science because he did not carry the inductive method into questions of religious belief. It is fortunate that the interests of science are not committed to the hands of such; for no possible rigor of method could make amends for the incurable narrowness of their imagination.

Science, we have said, demands intellectual integrity, and it rests with each individual, upon his own responsibility as an individual, to satisfy its demands. Science means truth; it exists to establish and advance truth, to build up in the world a coherent system of doctrine valuable for the guidance of human life and the further enlargement of human thought. It is not for one worker unnecessarily to judge another, or to impugn his fidelity to the great cause to which all owe a

common allegiance. All that we can require of any man is that he should honestly present any facts with which he may be called upon to deal, and that he should not refuse a candid examination to any relevant evidence in matters that lie within the scope of his inquiries. It is no part of the business of science or of any one speaking in the name of science to say how a given individual shall assess the evidence on a given question. There is such a thing at times as *force majeure* in intellectual as well as in political or military matters; and where this manifestly exists for one who works strenuously for science in his own field, others who do not feel the stress may properly refrain from disrespectful comments. We hold that the message of science comes home to every man in some measure or other, bidding him to work for the truth, to rid his mind of delusion, of partiality, of prejudice, of distorting self interest. Some respond to the appeal more perfectly than others; but it would not be safe to say that, where the most complete *tabula rasa* has been produced, there the greatest amount of scientific energy will be disengaged.

Holding these views, we are prepared to allow the fullest freedom to every one to reconcile in any way he pleases his religious convictions with his scientific views. *How* the reconciliation is effected is not our concern; it is the concern of each individual that it shall be an honest one. It is his concern and it is his responsibility; why should a stranger meddle therewith? The message of religion, reduced to its simplest terms, is identical with the message of science: "Be true!" and the man who consciously fails of intellectual sincerity will not feel much happier on the religious than on the purely intellectual side. It is high time that

Ephraim ceased to envy Judah, and Judah to vex Ephraim. There is ample work in the world both for science and for religion. It is for science to establish order among ascertained phenomena and to deduce from them the laws, or some of the laws, which govern the succession of events and prescribe the conditions of human life. It is for religion to uphold the sanctity of the moral law, to which science might be tempted not to assign any special pre-eminence, and to keep open an outlook into the origin and essential nature of things, and into those as yet unrealized possibilities of existence which science, full fed upon certainties, might be disposed to ignore. Science and religion may each watch over the other with advantage, seeing that each has a besetting sin—science a tendency to a hard intellectual pride, and religion a tendency to superstition and general indifference to external evidence. If each would recognize its own weakness and accept in good part the services of the other, the result would be a higher type of moral and intellectual life than has hitherto prevailed.

Science, it must, however, be understood, is unyielding in its demand that the adhesion of the mind to any opinion or conclusion shall be governed by evidence and not determined by mere views of expediency or convenience. There is therefore a somewhat unscientific tone in the remarks of our professor when he says: "We will continue to believe that in our creation we received from God a moral nature and an immortal spirit; that we have somehow become demoralized, and that the taint of our degeneracy is hereditary." It is not scientific to say "We *will* continue to believe" anything; if we *will* to believe, we turn our back on evidence, or at least are prepared to do so. And if it is not scientific to say

"we *will* believe," it is not very strictly theological to speak of believing that we have "somehow become demoralized." There is no "somehow," so far as we understand, in the orthodox view of this question, but a very definite "how." It is again very doubtful to our mind whether it is consistent with a profession of evolutionism to hold that the nature of man was originally pure and that "somehow" it degenerated. The course of evolution in the moral sphere is from actions guided by lower impulses to actions guided by higher impulses, from purely self-regarding actions to actions in which the welfare of others in ever-widening circles is taken into account. It is hard to imagine an evolution from a higher to a lower moral state.

There is a story told of John Wesley that a certain man who had come under his influence consulted him one day as to whether he might continue to wear a very handsome and expensive coat which he had bought. "Oh, yes," said Wesley, "just wear it as long as you can—as long as your conscience will allow you." More than this the great religious reformer would not say. Science has a very similar answer to give to certain inquirers: they are quite free to hold this or that opinion as long as they can—honestly. So long as they hold it honestly, Science has no fault to find with them. When the day comes, if it ever comes, that they can hold it honestly no longer, Science says, "Put it off." And any religion worthy of the name would say the same thing.

THE UPWARD STRUGGLE OF SOCIETY.

THERE is much in the present condition of society, not only in this country but in most of the civilized countries of the world, to give food for serious reflection as to the future

to all thoughtful minds. The laws of social evolution, we commonly say, have brought us to the point where we now are; and, as this is a considerable improvement on the conditions which obtained at certain periods in the past, we have no reason whatever to be anxious as to what the future may bring forth. On the other hand, when things are demonstrably going wrong, it seems a little too much like indifference and levity to trust to the operation of some law wholly independent of our own volition or effort to put them right. Evolution, after all, is only a kind of moving balance of actions and reactions: and we do not think that Mr. Spencer himself would undertake to guarantee us against many a bad half hour in the future, if we do not ourselves see that measures are taken to remedy obvious faults in the social development of our time. One of his books, every one will remember, is entitled *The Coming Slavery*—not a word of promise, to say the least of it.

The difficulties of the present time are, to a large extent, the result of the very successes which society has achieved in the past. Improved economic conditions have produced vaster accumulations of wealth than the world ever saw before, and in doing so have brought the spectacle of luxury before the eyes of the multitude in a manner, and with a frequency, only too well fitted to produce envy and unrest. In former times there were a comparatively few great ones of the earth whose splendor was a dazzling vision that, seen at comparatively rare intervals, lent a certain amount of poetry to the lives of the poorer classes. To-day there is no poetry in wealth: it is something that everybody understands, and from which no one, broadly speaking, feels content to be shut out. It is looked upon as the

key to the limitless satisfaction of desire, as the great emancipator from the otherwise hard conditions of life. In the days when wealth was associated with political power and responsibility, there was a kind of mute feeling in the multitude that such a combination required special qualities of mind and character which were not within the compass of all. To-day wealth stands by itself, wholly divorced in the popular mind from the notion of responsibility; and there is none so poor as not to consider himself fully qualified for the possession of any amount of it. It is not too much to say that many desire wealth, whether they are distinctly conscious of it or not, on account of the *irresponsibility* which they think or feel goes with it.

That this is not a healthful condition of the popular mind need hardly be insisted on. Yet it not only exists, but it is fed and ministered to in a thousand ways, and combated but in few. The rich, for the most part, justify by their mode of living and the education they give their children the popular idea of the irresponsibility of wealth. Their "pile" is made: henceforth let others labor for them. In their relations with the laboring classes they too often show a masterfulness bordering on tyranny. The conditions of business, they will perhaps say, if for a moment anything in the way of an excuse seems needed, make it necessary to be very authoritative and absolute in dealing with those whom they employ. Perhaps so, but all the same the situation is not a good one; for, just in proportion as relations of sympathy cease to exist between employer and employed, does the rich man rely more and more upon the power of his wealth, and the poor man look upon wealth as the one thing that counts in differentiating human beings from one another.

In his idea it is not the "boss" who makes the wealth, it is the wealth that makes the "boss."

That the daily press greatly tends to intensify the all but universal worship of wealth is obvious to every reader. Everything is measured and discussed in terms of money. Other things, such as literature, art, science, and religion, are treated as the non-essentials: money is the essential. To express it otherwise, the former are all partial—some of them very partial—interests; money is the universal interest. The Armenian atrocities awoke much apparent and some real indignation; but how much action did they set in motion compared with the discovery of gold on the Klondike? The whole political movement of the country is based on money considerations. The offices which still remain within the politician's grasp are the mainspring of all his efforts, while those which the civil-service law has removed from his control give him the feelings which a bird seen through a closed window gives to the necessary cat. Popular education, too, is laid out upon lines which point to the supremacy of money as an object of human desire. Not first the health of the body or the health of the mind, or the harmony of the human faculties, or the right ordering of the affections, but first the preparation for grasping money. And so our schools turn out into the world annually vast multitudes of would-be money-graspers—though many of them are none too well prepared even for that function—and an extremely limited number of individuals who have imbibed any true mental or moral culture as the result of from five to ten years' alleged education.

The extraordinary amount of attention bestowed upon sport and other forms of amusement in the

present day can not be considered a favorable sign. Open-air sports, no doubt, conduce to physical development; but it may be questioned whether the interest which they inspire arises from any sense of their importance in this respect. Local rivalries and the spirit of faction have much more to do with it. Another point is that talk about sport is the easiest kind of talk for empty minds; and what floods of it are sweeping the land to day no one needs to be told. Considering the wealth of matter for conversation which the modern world affords, it is lamentable to think how many households among the comfortable classes seem almost incapable of discussing any other subject morning, noon, and night than games of one kind and another and the "records" made by pitchers, batters, throwers, runners, kickers, and sluggers. People of presumed education, who will only scan the head lines of the news in regard to important social and political movements, will read every line of the prolix reports devoted to the doings of the sporting world. In the language of the day a match between two football or hockey clubs is an "event." All this means, we do not hesitate to say, a hurtful amount of mental dissipation; and it means also, we fear, the cultivation of idle habits. To what extent the work of our educational institutions is impaired by the undue devotion of the young to sports, many leading educators are prepared to attest. It is not, they will say, the time actually spent upon games that counts against study, so much as the everlasting occupation of brain and tongue with the discussion of games. It is there the evil lies.

Here again we see a result of the material advance of society. People are more self-indulgent because they have the means of being so. They

give more time and thought to amusements, because amusements are continually being brought to their very doors, and in a hundred ways forced on their attention. And yet there is a residuum in society that knows little of amusement. There is even a section of the community that lives below the level at which amusement is possible. A race enervated by self-indulgence is not in a fit condition to grapple vigorously with its social problems, and yet social problems too long neglected may take on some day a very alarming form. It is evident that there is much for serious-minded men and women to do to prevent an actual degeneration of character and intellect in our time. We want new and higher social ideals, and the question is how to create them. We want to destroy the fascination of mere money. We want more of equality in the community and less of caste; but the equality, or the approach to it, should be produced by a leveling up of those who are now below a decent standard of culture, not by any debasing of those who have reached such a standard. We want, of course we want, a purer tone in our politics; and that we can not have till those who make the politician are imbued with some sense of public duty. There are hundreds of agencies for good at work in the land; but many of these condemn themselves to partial sterility through the comparative narrowness of their aims, and sometimes through the exaggeration of language with which they urge their special reforms. It is human nature at large that wants uplifting; and if the light is in the world—as it is—the light of reason, of truth, of charity, why may we not hope to make it shine more widely, and so create for ourselves a social state whereof we shall not need to be ashamed?

Scientific Literature.

SPECIAL BOOKS.

WE know of no man better fitted to deal with the Scientific Aspects of Christian Evidences* than Professor Wright. He is both a man of science and a theologian; a trusted professor in an orthodox seminary who is at the same time a fearless investigator of the geological record and of the antiquity of man—and even a sturdy advocate of Glacial man. He is thus bound by the very nature of his attitude to give fair and even attention to both aspects of the question he sets out to discuss. He begins by admitting that Christianity is not capable of demonstrative proof, and is open to objections not easy to answer; but, he retorts, it is not alone among well-founded beliefs in being thus situated. In a large number of cases it is unreasonable to demand such proof. From a philosophical point of view, even modern science is more superficial than it is popularly represented to be, and has often to assume and even depend upon data that it can not prove or even comprehend. Its great advances have in reality only slightly touched the true basis of religious hope and aspiration. After showing that there are limitations to scientific thought and enumerating some of the paradoxes which science has to encounter in basing its fundamental principles, Professor Wright defines the view of God's relation to Nature most generally held by Christian philosophers as being that the operations of Nature go on in the main by virtue of forces communicated in the beginning but subject to insulated and systematic interpositions expressing the divine will. This leads to the question of miracles, of which "the economy of the strictly miraculous element in the Bible can never cease to be a surprise to the scientific students of human history." Such events as the Flood, the passage of the Red Sea, and the destruction of Sodom and Gomorrah are accounted for as having been brought about by the regular operation of natural laws, while the miraculous element in them lay in the co-ordination by which they were made to concur with other incidents to produce a special result. Concerning the grand culminating miracle of the wonderful life and the death and resurrection of Christ, it is shown that an unbroken chain of evidence exists from eyewitnesses down; and it has been re-enforced by very recent discoveries of documents composed by authors removed by at most only a single life from the possibility of personal communication with eyewitnesses. While these evidences, as well as evidences of the accuracy of Old Testament history, have always been ample, the author now finds them superabundant. "The question, then, which we are brought to face [concerning the story of Christ] is, Were the Christians of the first century under a delusion?" To this the last pages of the book are devoted.

The amusement and interest of watching a child's gradual initiation into the mysteries of "things" is best known to the "better half" of the community. But even our mothers do not properly appreciate that with this entertainment may be gathered much information of scientific value—of value

* Scientific Aspects of Christian Evidences. By G. Frederick Wright. New York: D. Appleton and Company. Pp. 362. Price, \$1.

not only for use in the bringing up of other children, but also because of the light which it may throw on the more difficult problems of general psychology. These thoughts have been brought to mind by a reading of Dr. Sully's *Children's Ways*.* The book consists of selections from the author's recently published *Studies of Childhood*. The somewhat abstruse discussions and the technical language of the psychologist, which were present in the first work, have been done away with, and the style and subject-matter adapted to the needs of the general reader. The book may perhaps be summed up imperfectly as a popular study of the various instincts, emotions, and habits of mind of the average child as exhibited in the several stages of his progress to a realizing sense of his true relation to his surroundings. The results and dangers of certain thoughtless modes of treatment and early education, and the means which should be taken for eliminating, as far as possible, the numerous barbarous atavisms which are manifested in the human *young one* are pointed out. Regarding the much-discussed question of the moral nature of the child, Dr. Sully very happily says: "So far from saying that child nature is utterly bad or beautifully perfect, we should say that it is a disorderly jumble of impulses, each pushing itself upward in lively contest with the others, some toward what is bad, others toward what is good. It is on this motley group of tendencies that the hand of the moral cultivator has to work, selecting, arranging, organizing into a beautiful whole." Some amusing stories, which are told as illustrating various typical characteristics of childhood, form a charming adjunct to the more strictly practical text. The book is extremely interesting reading, and should prove suggestive and instructive, especially to mothers, who are as individuals most unfortunately prone to look on the latest comer as simply "my baby," and to lose sight of the future in the immediate emotional pleasure of pleasing him. Dr. Sully suffers somewhat from this same fault of over-enthusiasm, occasionally allowing his interest to get the better of his judgment; but many will consider this a happy fault in these extremely practical days. On the whole it seems to us that this condensation of the "Studies" was well conceived, and that if it gains the circulation its importance deserves we may look to see a marked improvement in the observation and training of children.

A better characterization can hardly be made of Mr. Means's sober book on *Industrial Freedom*† than that given by Mr. Wells in the introduction which he furnishes to it. Its aim, he says, is to show that no good can come out of the proposals that are made for legislative interference between employer and employed or out of socialistic schemes. "The author considers the existing methods of distributing the products of human activity by means of the wages system, and demonstrates that it tends to establish working people in a state of independence rather than of subjection; to promote industrial freedom and not to produce 'industrial slavery.' He shows how intimately the welfare of laborers is connected with the prosperity of their employers, and how the attempts to diminish the wealth of corporations may diminish the fund of capital out of which laborers are

* *Children's Ways*. By James Sully, M. A., LL. D. New York: D. Appleton and Company. Pp. 193. Price, \$1.25.

† *Industrial Freedom*. By David MacGregor Means. With an Introduction by the Hon. David A. Wells. New York: D. Appleton and Company. Pp. 248. Price, \$1.50.

paid. He points out the dangers that arise from the misapplication and abuse of the taxing power, and indicates the peculiar evils to which such abuses will lead under our form of government." The complaint for which the schemes in question are offered as a remedy is defined by the author as being that after all proper allowances are made the differences in the distribution of the comforts and enjoyments of life are excessive and unjust. The argument opposed to this idea recognizes the fact that socialism implies the surrender of the freedom of the laborer, with the expectation that it will be more than made up for by the increase of his compensation. Existing conditions and relations are then surveyed to find whether any substitute for the existing organization can be adopted that will work better. If not, "meddling will cause more injustice than it will remove." Besides the relations of individual employers and corporations and their employed, monopoly privileges, the partnership theory, the limitation of the rate of wages, and the nature of profits and the effects of reducing them are reviewed. Social improvement must come, ultimately, through the increase of integrity and honesty among men. Honesty will not be likely to increase when the principle of regard for property and respect for existing rights ceases to be cherished. Conscientious and cultivated men are warned of the responsibility that rests upon them. The movement toward the establishment of socialism will leave ineradicable traces in the shape of laws that can hardly be repealed, institutions that will be permanently mischievous, and debts that will burden children yet unborn. The greatest danger that threatens our republic lies in this tendency.

GENERAL NOTICES.

THE authors of the *Manual of Bacteriology** are both university lecturers; Mr. Muir on pathological bacteriology at Edinburgh, and Mr. Ritchie on pathology at Oxford. They explain that the science has become so extensive that in a book of this size the treatment must be restricted to some special departments, or it will be superficial. The present work being intended first for medical students and practitioners, they have considered in it only those bacteria associated with disease in man. The effort has been made to render the work of practical utility for beginners, and elementary details have been given in the accounts of the more important methods. The evidence of certain bacteria having ætiological relationships with corresponding diseases, the general laws governing their action as producers of disease and the effects of various modifying circumstances are considered. The subject is treated

under the heads of general morphology and biology of bacteria, methods of cultivation, nonpathogenic micro-organisms, the production of toxines, suppuration and allied conditions, the relations of bacteria to disease, and, in detail, the more important diseases in which they have been proved to make their effects felt. In the appendix four diseases—small-pox, hydrophobia, malarial fever, and dysentery—are treated of, in two of which the causal organism is not a bacterium, while in the other two its nature is not yet determined.

Amid the countless impressions which crowd upon the brain, not only by every avenue of sense, but also in connection with organic action, it is not to be wondered at that a large number should escape our recognition. These are faithfully registered, however, no less than the ones to which we attend and in time form a background of memory, a *Subconscious Self*,* which may influence or

* *Manual of Bacteriology*. By Robert Muir and James Ritchie. With 108 Illustrations. Edinburgh and London: Young J. Pentland. New York: The Macmillan Company. Pp. 519. Price, \$3.25.

* *The Subconscious Self and its Relation to Education and Health*. By Louis Waldstein, M. D. New York: Charles Scribner's Sons. Pp. 171. Price, \$1.25.

control the individual. Dr. Waldstein shows how this can be roused to activity by the repetition of some impression, an unobserved odor, a sound, or familiar surrounding, and create in us an emotion, or mood, for which we can not otherwise account. Likes and dislikes, antipathies, "love at sight," even religious feeling may be the offspring of this subconscious self. In the earlier years of life, before consciousness is fully developed, it has its largest growth. It is important, therefore, that the impressions received by the young be carefully guarded. As nervous disorders spring from the predominance of this hidden nature, the inhibiting will and judgment must be cultivated. "It is in every case a grave risk to delegate the educational and directing powers of a mother to any stranger." Life in the country supplies the best conditions for the child. To the subconscious self it furnishes the impressions of restfulness and singleness of purpose, while the conscious intellectual activity is exercised in learning to distinguish the differences in natural objects. In the opinion of the author, the subconscious self is always the basis of the æsthetic mood, and not only in a receptive fashion, empowering us to enjoy music, art, and poetry, but it is also responsible for the creations of genius. He enters here upon debatable ground, for the assertion that "Shakespeare perceived without effort great truths through the subconscious self" is somewhat contradictory. Perception involves classification and implies consciousness. Several antitheses are brought forward which are probably merely casual. That between music and mental analysis suggested by Charles Darwin is amply disproved by the case of Chauvenet, distinguished mathematician and musician; also that "careful observers and those of analytical habits can not abide perfumes" is equally doubtful. It is certainly unscientific to connect two co-existent characteristics as cause and sequence when no causative relation has been proved. The author suggests that "heredity" is often invoked to account for habits that are the effects of early impressions or mimicry. This is credible where there has been contact, but not where a generation has intervened. Neither are inherited tendencies "unalterable," "beyond our influence." If recognized in time they may be modified even as

the character of leaves may be changed by varying food and temperature, or seedless oranges produced by culture.

This work,* forming a supplement to the *Journal of Morphology*, vol. xii, No. 2, is the outcome of ten years' study of protoplasmic structure in the Protozoa, Metazoa, and higher forms of life. The author made her observations upon living material although comparing it with various "prosserved" forms, and concludes that the original delicacy of structure is altered by the reagents commonly used. One object, therefore, of publishing her researches is to induce the biologist to observe the living substance as the naturalist studies the habit of an organism. Acknowledging her indebtedness to Bütschli's work, she claims that the structure known by his name is not the final constitution of the protoplasmic foam, but only one of a graded series yet undiscovered. She finds that there is not only an external environment, but an internal one which the living substance is ever seeking to control, to render itself more independent. As the result of her investigations, a new biological standpoint is offered, that the true organism is the invisible vesicular substance; all powers, functions, and organs are primarily for this, and only incidentally for the animal and plant. Reflex actions are noted as pointing toward this view, in establishing the fact that activities seemingly of the organism are products of local function. Man thus finds himself but a secondary affair, a mere phase of protoplasm, and it is unquestionably "difficult to overcome the natural egotism of the unit" and persuade him of this as truth without many more facts than are brought forward in the present volume. The plea, however, that the phenomena of life is best observed in living protoplasm is well founded and supported by the circumstance that the chemical properties of dead and living cells are unlike, shown in a pamphlet by Prof. Oscar Loew.†

The *Eleventh Annual Report of the Commissioner of Labor, 1895-'96* (Washington, Government Printing Office), comprises the results of an investigation relative to the

* The Living Substance, as such and as Organism. By Gwendolen Foulke Andrews. Boston: Ginn & Co. Pp. 176. Price, \$1.50.

† Popular Science Monthly, vol. li, p. 711.

comparative employment of men, women, and children at two periods of time, and is made in accordance with a joint resolution of Congress. The work now being performed by the department is more varied and extensive than at any other period of its existence. It includes an investigation relating to the effect of machinery upon labor and the cost of production; a report upon wages paid in leading countries; inquiries into various aspects of the liquor traffic; and inquiries relative to the municipal ownership of gas, electric, and motor plants; to the condition of the Italians of Chicago; and into the economic progress of the negroes.

The *Journal of Osteopathy* is a periodical devoted to osteopathy, or a new system of healing without drugs, which seems to have found favor with considerable numbers of people, and has been recognized by law in four States. It is published monthly at the American Institute of Osteopathy, Kirksville, Mo., at \$1 a year.

The Story of Oliver Twist, condensed for home and school reading, by *Ella Boyce Kirk* (Appletons, 60 cts.), has recently come to us. It is part of a series of "home-reading books" designed to supplement the ordinary school work of the child, and is one of the results of what was originally the university extension movement, but which could now more appropriately be called the school-extension movement, as its principles have been applied all along the line down almost to the kindergarten. The author thus describes her book: "I have tried to present one of Dickens's most popular stories as nearly as possible in the form (judging from his *Child's History of England*) that he would have put it if he had written it for young readers. I have used his language, I have not presumed to change or modify his expression, but everything that a child would be likely to skip has been elided. The action is thus accelerated to suit the most impatient reader."

Education from a Publisher's Standpoint, an address delivered before the National Educational Association on July 7th, by Mr. *Gilman H. Tucker*, takes the ground that the work of the publisher is closely bound up with that of the teacher, and that co-operation and sympathy are the necessary

watchwords. Mr. Tucker is Secretary of the American Book Company, and hence an authority on text-books. The address is published in a small pamphlet of twenty-three pages.

In *The Mother's Council*, or the Kindergarten in the Nursery, Mrs. *Louise Pollock* attempts to arrange a course of mental and physical training for use by the mother or nurse in the nursery. It is based on Froebel's *Mother Book of Song and Play*. The applications begin when the child has reached the age of three months; the first one consisting of the swinging of a yarn ball in front of the child's face, and singing the following inspiring melody:

Here, there, here, there,
Coming, going,
Forward, backward,
The little ball comes, it goes.

The book also contains a number of "Educational Rules," the first of which is, "Be careful what habits a child acquires during the first month of his life. Do not rock or walk him to sleep, unless you wish to do it for years to come." This is undoubtedly good science, but rule 29, which follows, is somewhat doubtful in this respect. "If the house is so constructed that you can not conveniently have your head to the north while sleeping, the next best way is to sleep with your feet to the west. The electrical currents come from the east, and it is best they should reach you from head to foot, rather than *vice versa*."

The American X-Ray Journal, monthly, *Heber Roberts*, M. D., editor, is devoted to practical X-ray work and allied arts and sciences, with special reference to the physical improvement of man. Published at St. Louis, Mo., \$1 a year.

The *Annual Report of the State Geologist of New Jersey* for 1896 contains the reports of progress by R. D. Salisbury and G. N. Knapp on the survey of the surface formations, and of H. R. Kummel on the Newark system or New Red Sandstone; and reports by J. E. Wolff on Archæan Geology (Sussex County), Lewis Woolman on Artesian Wells (Stratigraphy of the Fish House Black Clays); C. C. Vermeule on the Flood of February 6, 1886, in Northern New Jersey; C. C. Vermeule on the Drainage of the Hackensack

and Newark Tide Marshes; G. F. Jenkins on the Iron Mining Industry; and John Gifford on Forestry in Holland, Germany, Switzerland, and France; with mineral statistics. The reports are accompanied by excellent maps.

The last volume in Appletons' Home-Reading Series to reach us is entitled *Curious Homes and their Tenants*. It consists of a popular description of some of the more curious human and animal "homes." The author, James Carter Beard, disclaims any attempt to do more than attract the attention of his readers to the subject in the hope of awakening in them the desire for a more thorough acquaintance with an interesting and instructive study. As the chief function of the animal or plant seems to be the perpetuation of species, we may expect the highest and most perfect qualities and instincts to be manifested in the solution of the cares and duties of parentage. To give some idea of the scope of the book we take the following chapter headings: Cave Dwellers, Birds that build Edible Nests, Moles, Jumping Mice, Bees and Wasps as Miners, Ants at Home, Cliff-dwellers, Butterfly House, Human Nest Builders, Eskimo Homes, Human Lake-dwellers, A City of Birds. Illustrations are numerous and well chosen.

The purpose of the work *Opposites of the Universe* is explained by the author, Mamie Sands, as to demonstrate that the universe is a whirl of opposites, and that these opposites are eternal, "which implies that they are neither creatable nor destroyable when the whole kosmos is considered." The book is to be in six parts. The first part, now before us, is a Discourse about Immortality, in which "opposites in special" are considered. They are arranged under numerous headings, such as chemiological, astrological, electrological, etc., opposites; and the theses are enforced by citations from philosophical and other writers of all ages. (Peter Eckler, New York, publisher. Price, 50 cents.)

Mr. J. Wilson, in common with most of his human brothers, is not satisfied with the present management of "things," so he has written a book on the rights and wrongs of men, under the title *Self-control, or Life without a Master*. He states its aim to be

the bringing of the reader to a realizing sense of the fact that "no man has a right, under any circumstances or under any conditions, to be the master of another man." He contends that under the existing order the child is a slave to his nurse, then to his parents until he is twenty-one, and from this time until his death to the state. "He does not believe in masters or governments in any form." He claims no originality for his thoughts; "he would not deny for a moment that such thoughts have come or will come to other men." And further he says: "If the reader has not full confidence in his" (the author's) "ability to discuss this question fully and fairly, and if he is not confident that the author knows just what he is saying and what he is talking about, he ought to select some other book for perusal," which is certainly fair enough. The closing paragraph of the volume contains the following prediction: "What happened in Paris in the eighteenth century is liable, I may say is certain, to happen in America some time during the twentieth." (Lemcke & Buechuer, New York.)

We have received from C. W. Bardeen (Syracuse) *A Government Class-book of the State of Michigan*. It is a review of the form of State, county, city, and township government which prevails in Michigan, stating the function and powers of the various governing bodies and officials, and containing as two appendices the Constitutions of the State of Michigan and of the United States.

Not In It, by Anna Olcott Commelin, is a story intended to show the obligation under which the rich man is to aid his poorer neighbors. It recounts the history of several individuals in varying conditions of life, showing the value of well-timed aid and the great suffering which poverty entails on those who are suddenly reduced to it from comparative wealth. (Fowler & Wells, New York, 75 cents.)

The first series of lectures by A. D. Waller on physiology, which was delivered at the Royal Institution in the spring of 1897, has just appeared in book form under the title *Animal Electricity*. The material consists of six lectures. The first is a demonstration of the phenomenon of animal electricity, the

second describes the methods of experimentation, and the remainder deal chiefly with experiments bringing out the various laws and phenomena which have thus far been ascertained. The printed lectures contain considerable matter which was not considered appropriate for the popular lectures, "but which is nevertheless essential to the further study of the subject." Three of the lectures in the original course on the action of nitrous oxide are not included, but are announced as reserved for a "second series." There are a number of explanatory diagrams and illustrations. (Longmans, Green & Co., New York. \$1.50.)

The arguments in favor of the vertical system of handwriting have been set forth in the *Popular Science Monthly*. We are glad to see that it is attracting the attention of publishers of school books. One of the simplest and most convenient applications of it is made in *The Natural System of Vertical Handwriting*, by A. F. Newlands and R. K. Row, which is published by D. C.

Heath & Co. The authors are represented to have been the first to advocate the new system in America, and to have made the first and longest-continued experiments in it. With them legibility is the first consideration, and they believe that handwriting should be as much as possible like print, consistently with convenient manipulation. The course consists of six books of progressive lessons, presenting a beautiful, plain, open hand, to which two books of social and business forms are to be added.

Stewart's Telegraphic Code consists of a system in which numbers are represented by combinations of letters. Telegraph companies in transmitting numbers charge for each figure as a separate word. By means of this system Mr. Stewart represents any number from 1 to 999,999 in a word of ten letters or less. For instance, 74,013, which, if sent as it stands, would be charged for as six words, is in the system represented by "rulidoka," which would, of course, go as one word. (Author, St. Paul, Minn.)

PUBLICATIONS RECEIVED.

Agricultural Experiment Stations. Bulletins and Reports. Connecticut: Twenty-first Annual Report for 1897. Part I. Food Products. Pp. 64; Part II. Fertilizers. Pp. 74; Part III. Various. Pp. 74.—Iowa: Bulletin No. 36. Eight Articles. Pp. 60.—New Jersey: No. 124. Fertilizers. Pp. 98; No. 125. The San José Scale, and how it may be Controlled. Pp. 16.—New York: No. 125. Popular edition. Tomato Forcing. Pp. 3, with plates; No. 126. Feeding Experiments with Chicks and Capons. Pp. 14, and popular edition of the same. Pp. 8; No. 129. Commercial Fertilizers. Pp. 72; No. 130. A Bacterial Disease of Sweet Corn. Pp. 16; No. 131. Oat Smut. Pp. 12; No. 132. The Source of Milk Fat. Pp. 33.—Pennsylvania: No. 28. The Fungous Foes of the Farmer. Pp. 19.—Purdue University: No. 66. Indoor Culture of Lettuce. Pp. 8; No. 67. Wheat and Corn as Food for Pigs. Pp. 12.—United States Department of Agriculture: Meadows and Pastures. Pp. 24; The Gipsy Moth in America. Pp. 39; The Jack Rabbits of the United States. Revised edition. Pp. 88; North Dakota Climate and Crop Service of the Weather Bureau. Report for November, 1897. Pp. 8.

Bailey, L. H. Lessons with Plants. New York: The Macmillan Company. Pp. 491. \$1.10.

Björnlund, Philip R. Whittaker's Mechanical Engineer's Pocket Book. New York: The Macmillan Company. Pp. 377. \$1.75.

Brown, John. Parasitic Wealth; or, Money Reform. Chicago: C. H. Kerr & Co. Pp. 169. \$1.

Bulletins and Reports. Department of Labor, January, 1898. Pp. 140.—New York State Museum, October, 1897. On Road Materials and Road Building. Pp. 134, with maps.—Bureau of American Republics, January, 1898. Pp. 180.—Report of the Bureau of Labor Statistics of Connecticut for 1897. Pp. 240.—Report of the Director of Physical Training in Public Schools of Washington, D. C., 1896-'97. Pp. 22.—Report of Public

Schools of the District of Columbia, 1896-'97. Pp. 305.

De Witt, T. H. Benton. A Correspondence between an Amateur and a Professor of Political Economy. Philadelphia. Pp. 19.

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Fragments of Science.

The Effect of Trade Unions on Individual Advance.—The growth of a country in civilization and wealth depends chiefly on the efforts of its individuals. The great advances in modern science and industry have been made by men a little ahead of their neighbors in clear-sightedness and push. Hence, anything which puts a curb on individual effort and ambition is antagonistic to the best interests of society and civilization. The trade union, which in its inception had only a co-operative function, enabling the men in a given trade to help one another in cases of injury, sickness, etc., and to meet representatives of other industries for furthering trade relations and association, has in the modern industrial world assumed quite a different function, whose worst manifestation is the stifling of whatever individuality and push the workman may have, and forcing him to limit his work to that of the least efficient of his fellows. The fact that Brown can do in a day half as much more work than Jones, and do it better, is an item which if known is not considered unless he does it, in which case he is informed that he is doing too much and must "let up." The official amount is prescribed, and no one, whatever his ability, is expected to exceed that. There can be only one result of a system which discourages a man's doing his best, and limits him to the capacity of the poorest workman in the union, and that is to destroy individuality and ambition, the two most powerful forces which work for human advancement. That

such is the real effect of the trade union has recently received additional confirmation by the statements of a skilled mechanic who has actually "been through the mill" and risen from the ranks. In the November number of the Engineering Magazine, Mr. Hiram S. Maxim, widely known for his important industrial and scientific work during the past fifteen years, and who began his career as a common hand in a machine works in Fitchburg, Mass., writes on the subject of trades unions. He shows that in every instance the effect of the union is to decrease the work, both in quantity and quality, demoralize the workman, and foster a tendency to soldiering and dishonesty.

The Metals of Canada.—In his address at the British Association on the Metals of Canada, Prof. Roberts Austen showed that the recognition of the extent and variety of the mineral wealth of the Dominion had been comparatively recent, and the development of the related industries slow. This was due partly to the policy pursued by the Hudson Bay Company of keeping the country wild for the sake of the fur-bearing animals; partly to ignorance in the mother country of the resources of Canada; and partly to the difficulty of access to the mining districts before the railroads were built. In speaking of the Dominion generally, the richness of the deposits and the hopefulness of prospects must be kept in view rather than the immediate output; but it should be remembered

that since the meeting of the British Association in Montreal in 1884 the mineral production of the Dominion had more than doubled. The principal metals of Canada are gold, silver, nickel, copper, lead, and iron; besides these, manganese, chromium, antimony, and zinc occur, with platinum and rarer metals. The gold is at present obtained from the provinces of British Columbia, Ontario, and Nova Scotia. In Ontario, discoveries of this metal have been made over an area of about two thousand square miles, in a tract one hundred miles wide and two hundred miles long. As for silver, the Slocan mines and those of Trail Creek and East and West Kootenay appear to be of extraordinary richness. The lecturer dwelt at some length on the importance of the resources of Canada in iron and steel, and mentioned nickel, which greatly affects the quality of steel, as a metal the importance of which it is impossible to overestimate, and chromium as a metal with which the manufacturer of projectiles would probably triumph over the man who put nickel into his steel armor.

The Cruelties of Antivivisectionists.—Dr. Charles Minor Blackford, after reviewing the present position and needs of pathology in an address on that subject before the Medical Society of Virginia, spoke of a danger as confronting it which has passed away from every other science. Prof. Andrew D. White, he said, "has lately given us a history of The Warfare of Science, in which he has told, plainly and simply, the story of the army of martyrs to scientific truth, and his record is one that may well make us blush for humanity. It is true that we no longer have to fear the stake and rack in investigating Nature, but, though life and limb are safe, the same spirit survives in other forms. A number of persons, whom, for the sake of our civilization, we will assume to be well intended, are striving in many ways to oppose freedom of thought as much now as in the fifteenth century. They lay great emphasis on the commandment 'Thou shalt not kill,' but ignore 'Are ye not worth many sparrows?'" Assuming a number of facts that they are unable to prove, they endeavor to make those whose lives are devoted to saving life and relieving pain appear the most cruel of wretches. Never having seen the interior

of a laboratory, they erect an imaginary one, and coolly assert that the scenes that their own imaginations have conjured up go on in them, and at their meetings vote resolutions condemning physiologists for attempting to save life, and legislatures for forbidding the wearing of our song birds on their hats. In our climate there are not five days in as many years that it is necessary to wear furs for shelter from cold, yet two of the greatest nations of the world have been on the brink of war for some years past, and a harmless and beautiful race of animals have been well-nigh exterminated to supply what is purely an article of vanity and luxury. To supply the 'aigrettes' worn on woman's bonnets, female herons have to be killed at a time when the death of the mother means the death of her brood; and yet when a British Humane Society appealed to the leader of the British fashionable world to give up this senseless and cruel ornament, it met an abrupt refusal. Similarly, the American bison has been exterminated to gratify vanity; the same fate awaits the elephant; and, I will venture to say, the pain endured by geese to supply the 'live-geese feathers,' and by horses in having their tails docked and in wearing the 'kimble-jack'—both thoroughly useless affectations of fashion—is greater than that endured by any animals in a laboratory. In this latter case, not merely do the horses have to endure, *without an anæsthetic*, cutting through a highly nervous part, but they are rendered defenseless from the attacks of flies and other insects by the loss of Nature's weapon, and are forced to drag heavy vehicles at high speed with the head held in an unnatural position by a rough bit in the tender mouth. We can picture the members of antivivisection societies driving to their meeting with horses so mutilated, removing their sealskin coats and aigretted bonnets, and denouncing attempts to find a cure for diphtheria.

"'Oh, wad some power the giftie gie us
To see oursel's as ithers see us!'"

Economical Experiences in Canada.—In a study of certain characteristics of the history of economics in Canada, presented to the British Association, Prof. Adam Scott describes this history as having been, up to the beginning of the present century and for

some time afterward, mainly a record of numerous governmental experiments covering the leading features of economic life. The results were mostly of a negative character, but were valuable for the student. Study of the conditions in French Canada should be accompanied by a study of the conditions that prevailed in France, England, and the English colonies. The differences between the colonies were due not so much to their location, their race, or their products as to the regulations by which they were controlled. The French bureaucratic system, with its tendency to minute interference with every aspect of social life, was opposed in New England by a system which left to the colonists the utmost liberty in the practical direction of their affairs. Much good was accomplished in Canada under the influence and direction of Colbert, but as much or greater harm was done by incompetent administrations later. In Canada despotism was tempered by access to the woods, those too heavily burdened readily taking to the ways of the savages, a fact that gave the French an influence upon the Indians greater than could have been expected, inasmuch as their pecuniary advantages lay almost altogether with the English. Although in theory the English colonies were dependent for all things upon the home government, they were largely left to themselves, and when George III thought to atone for past neglect by vigorous administration it was found that the lapsed authority could not be recovered. Thus, while in Canada a colony had grown up dependent on European influences, the English colony had become accustomed to look to itself for all things. The whole study was presented as emphasizing the necessity in theoretic economics of keeping in mind differences in conditions and in their range of operation and influence.

Singing Flames.—In a recent number of the *American Journal of Science*, Mr. H. V. Gill has an interesting paper on The Theory of Singing Flames. The phenomenon of a gas jet burning inside an open tube, emitting a musical note, is one of those facts which, although known for many years and much written about, has never been fully explained. Among the more interesting theories was that of De la Rive, who supposed the sound

to be due to a periodic condensation of the water vapor produced in the combustion of hydrogen gas. Faraday showed the inadequacy of this theory by the use of a flame which did not form water vapor, and proposed in its stead the theory that the so-called singing was caused by successive periodic explosions of a mixture of gas and air. This was accepted by Tyndall. Another theory which has been proposed is that the sound is produced by vibrations maintained by heat, the heat being communicated to the mass of air confined in the sounding tube at a place where in the course of vibration the pressure changes. Sondhauss performed a series of experiments, his chief conclusion being that the condition of the column of gas in the supply tube had an important influence on the phenomena. Mr. H. V. Gill sums up his conclusions as follows: "We think we have made it clear that the pressure on the gas plays the important part in this phenomenon, and that a consideration of the reactions we have described will be found to explain the many facts noted in the case of a singing flame, some of which we have alluded to. We look, therefore, on the chief cause as a mutual reaction between the pressures in the tube and on the gas, the energy necessary to sustain the note being supplied by the pressure on the gas and the action of the flame. We may compare the singing flame to the siren, in which the current of air causes the disk to rotate, the note being produced by the reaction of the disk on the current of air. . . . We have, then, three kinds of singing flames, one depending on changes of pressure, another on air currents, and a third depending at once on both changes of pressure and on air currents."

Sanitariums for Consumptives.—The urgent need of sanitariums for the consumptive poor in our large cities was forcibly presented by Dr. S. A. Knopf in a paper which he read before the American Public Health Association in October, 1897. The author shows, in the first place, that the homes of these invalids are as unsuitable as they can be for their proper treatment; that with them their families and fellow-tenants are sure to be infected, and the neighborhood is in danger. Neither can they properly be received in the general hospitals, where the

annoyance to other patients in the ward—always a great danger in itself and sometimes fatal to the patients—is added to the danger of communicating tuberculosis. They should be isolated. A number of instances are cited of special hospitals for consumptives maintained by private enterprise, to show that patients can be cared for economically at such institutions, and with a success according to the stage of the disease when they are taken there. At St. Joseph Hospital, New York, fifteen hundred far-gone cases are cared for annually at an average cost of fifty cents a day. At Saranac Lake, where incipient cases are taken, from thirty to thirty-five per cent are cured with an average stay of eleven months and ten days; at Liberty fifty per cent are improved after three months, and about twenty-five per cent are cured. At Sharon Sanitarium, near Boston, twenty-five per cent of “arrested cases” are reported. Other sanitary advantages of inestimable value to the community are mentioned as likely to accrue from the establishment of such sanitariums and their proper management. Patients will, for instance, receive there a proper sanitary education, and be drilled in sanitary practice, taking which to their homes, they will become educational factors in public hygiene. Dr. Knopf proposes to have these sanitariums controlled and maintained by States and municipalities. It would be well to have the infection of corruption removed from State and municipal politics before this is done.

Crater Lake, Oregon.—Crater lakes are defined by Mr. J. S. Diller as lakes that occupy the craters of volcanoes, or pits of volcanic origin. They are most abundant in Italy and Central America, regions in which volcanoes are still active; and they occur also in France, Germany, India, the Sandwich Islands, and other parts of the world where volcanic phenomena have been important in geological history. Only one is known in the United States, and that is in southern Oregon, in the heart of the Cascade Range. It is interesting to the geologist and inviting to the tourist and health-seeker. It is as yet reached only by private conveyance over about eighty miles of mountain roads from Ashland, Medford, or Gold Hill, on the railroad. The lake, which appears to be about the height

of Mount Washington above the sea, is surrounded by a series of unbroken cliffs ranging from 6,759 to 8,228 feet in height, or from more than five hundred to nearly two thousand feet above it, which are clearly reflected in its deep-blue waters. The outer slope of this rim is gentle, while the inner slope is abrupt and full of cliffs. The rim crest is generally passable, so that a pedestrian may follow it continuously round the lake—a circuit of about twenty miles—with the exception of short intervals on the southern side. The inner slope of the rim, though precipitous, is not a continuous cliff, but is made up of many cliffs, whose horizontal extent is generally much greater than the vertical. Other elements of the inner slope are forests and talus, and these make it possible at a few points to approach the lake, not with great ease, but, if done carefully, with little danger. On arriving at the water's edge, the observer is struck with the fact that there is no beach. The steep slopes above the surface of the lake continue beneath its waters to great depths. “Here and there upon the shore, where a rill descends from a melting snow bank near the crest, a small delta deposit makes a little shallow, turning the deep blue water to pale green.” Among the most salient features of the lake are Wizard Island and the Phantom Ship. Wizard Island embraces an extremely rough lava field and a cinder cone, from the base of which the lava has been erupted. The cinder cone is a perfect little volcano with steep, symmetrical slope, eight hundred and forty-five feet high, and surmounted by a crater eighty feet deep, and is so new and fresh that it is scarcely forested, and shows no trace of weathering. The Phantom Ship is a craggy little islet with features that suggest the name. “Aside from its attractive scenic features, Crater Lake affords one of the most interesting and instructive fields for the study of volcanic geology to be found anywhere in the world. Considered in all its aspects, it ranks with the Grand Cañon of the Colorado, the Yosemite Valley, and the Falls of Niagara.”

The Enchanted Mesa.—An article in a recent copy of the *National Geographic Magazine*, by F. W. Hodge, gives an account of some interesting exploratory work done by

him in the valley of Acoma in central New Mexico. The *Katzimo*, or enchanted mesa, is an isolated mass of rock rising from the center of the plain to a height of four hundred and thirty feet. Native tradition has it that this was once the home of their ancestors, but during a great convulsion of Nature, at a time when most of the inhabitants were at work in their fields below, an immense rocky mass became freed from the friable wall of the cliff, destroying the only trail to the summit and leaving a few old women to perish on the inaccessible height. This tradition has been strengthened by the finding of numerous fragments of pottery of very ancient type in the talus beneath the wall where it is said the path originally existed, and also by traces of hand and foot holes for some distance up the side of the cliff. Professor Hodge, by the aid of an extension ladder and several hundred feet of rope, after two hours' hard work, succeeded in reaching the summit of the mesa. The first recorded ascent was that of Professor Libby, of Princeton, in July, 1897. Several ancient potsherds and a curious sort of monument were the only archæological finds. Professor Hodge, however, drew a map of the surface and accurately determined its altitude.

The Age of Trees.—The following information is taken from a recent circular of the United States Department of Agriculture: In all the timber trees of the temperate portion of our country the wood of the stem is laid on in sheets, which on any cross-section appear as so many concentric rings. Generally these rings are sufficiently well defined to be readily counted, and since only one is formed during each growing season they furnish a very convenient record of the age of that portion of the tree. In the cross-section of a pine, fir, or cedar these rings appear as alternate narrow bands of lighter and darker color, the dark line, or "summer wood," occupying the outer portion of any one ring, and being sharply contrasted against the lightest part of the inner lighter, or "spring wood." These rings are conspicuous through rows of pores, each row occupying the inner or spring-wood part of a ring and being separated from the row of pores of the next ring by wood practically devoid of large pores. In the "diffuse

porous" woods, like birch, poplar, tulip, etc., the rings are generally less conspicuous, being defined by a mere line, often scarcely perceptible in the fresh wood, and due to the fact that the outermost cells of the summer wood are always small, flattened in form, and have thick walls, while the adjoining innermost cells of the spring wood of the neighboring ring are much larger, not flattened, and always have thin walls. The growth of these rings is very even and regular, especially in young and thrifty timber, where the conditions for tree life are favorable. Where the conditions are not good the ring formation varies in a number of ways, and is a not at all reliable source for obtaining the age of the tree. A cross-section from one to two feet above the ground should have added to the number of rings found from five to seven years, as the seedling would probably have required that period to reach a height of two feet.

The Pitch Lake of Trinidad.—Some romances and exaggerations of which the pitch lake of Trinidad has been the subject are corrected by Mr. Albert Cronise, of Rochester, N. Y. Its area, height, and distance from the sea have been overestimated, and a volcanic action has been ascribed to it which does not really exist. It is one mile from the landing place, is one hundred and thirty-eight feet above sea level, is irregular, approximately round, and has an area of one hundred and nine acres. Its surface is a few feet higher than the ground immediately around it, having been lifted up by the pressure from below. The material of the lake is solid to a depth of several feet, except in a few spots in the center, where it remains soft, but usually not hot or boiling. But as the condition of the softest part varies, it may be that it boils sometimes. The surface of the lake is marked by fissures two or three feet wide, and slightly depressed spots, all of which are filled with rain water. In going about, one has to pick his way among the larger puddles, and jump many of the smaller connecting streams. Each of the hundreds of irregular portions separated by this network of fissures is said to have a slow revolving motion upon a horizontal axis at right angles to a line from the center of the lake, the surface moving

toward the circumference. This motion is supposed to be caused by the great daily change in temperature, often amounting to 80°, and an unequal upward motion of the mass below, increasing toward the center of the lake. A few patches of shallow earth lying on the pitch and covered with bushes and small trees are scattered over the surface of the lake.

Nature's Landscape Gardening.—A curious and interesting and yet easily explainable phenomenon is mentioned in a recent paper by N. F. Drake, in the *Journal of Geology*, on *The Topography of California*. In assisting to map a number of sand-dune areas along the coast in San Luis Obispo County it was noticed that where the sand was free from vegetation or obstruction it was piled in ridges at right angles to the prevailing sea breezes; but that where patches of vegetation grew, the dunes became parallel to the direction of the wind, and where the vegetation became thicker over the ground the regularity of the arrangement of the dunes was more broken. The reversal of the direction of the ridges where patches of vegetation existed was accounted for as follows: A mass of grass or bushes once started would check the sand from moving at that point and make a shelter for deposits to the leeward. This point of the sand dune now being more stable, other plant growth would spring up—mainly on the leeward side, so as to lengthen and increase the elevation of the ridges, while the unprotected sands at either side would

drift away, thus forming narrow parallel ridges in the direction of the prevailing winds. Ridges from fifty to seventy-five feet high and four to six hundred feet long, or even longer, were not uncommon where the sand dunes were extensive.

Pegamoid.—Pegamoid is a substance of similar composition with celluloid, possessing its desirable qualities, while it is not inflammable and does not lose shape when heated. It was discovered by an English lithographer seeking a means of protecting the posters of his making from injury by the atmosphere. Its composition is a secret, but it appears to contain a nitrified cellulose, alcohol, and camphor, or the essential constituents of celluloid, together with some substances intended to increase its impermeability and make it supple and unflamable. It may be applied in thin varnishes to any material—cloth, leather, paper, etc.—so closely that it can not be separated by any mechanical means, and so as to form an impermeable coating, easily cleaned by washing, and proof against heat, grease, and alkalies, while it has the further property of communicating its qualities to the material to which it is applied without destroying its individuality. Pegamoid cloth is a cotton fabric covered with a suitable thickness of pegamoid and gauffered. The process of manufacturing it is very simple, and consists in dyeing the cloth in the desired color, mechanically coating it with colored pegamoid, and stamping it. This is only one of the innumerable applications of which pegamoid is capable.

MINOR PARAGRAPHS.

THE method of reproduction of the eel, long a puzzle in zoölogy, has been discovered. Young eels were known, but at too advanced a stage of development to give any clew to their primitive or larval state, and no eels in this condition had ever been recognized. Theodore Gill suggested in 1864 that larval eels might be identified with the *Leptocephalus*, an animal which is found on the British shores, in the Mediterranean, and on the surface of the water in various parts of the world. It has a body several inches in length, thin, and of uniform width, like a piece of ribbon, transparent, and unpig-

mented. Professor Gill's suggestion was verified by the investigations of Yves Delage in 1886 and Grassi and Calandruccio in 1892 and 1893, who showed that two species of *Leptocephalus* were larvæ respectively of the conger and the common eel. Fuller accounts of the observations of Professors Grassi and Calandruccio have been published recently in the *Proceedings of the Royal Society* and the *Quarterly Journal of Microscopical Sciences*. The specimens investigated were captured, along with deep-sea fishes, in the Strait of Messina, where the currents are strong and beset with whirl-

pools. Hence it is inferred that the spawning of eels and the development of the eggs and larvæ take place at great depths, and the young are brought to the surface by movements of the water. Professor Grassi believes that the elvers, or eel fare, which ascend rivers are already a year old.

DR. GEORGE M. DAWSON has found evidence—consisting chiefly of belts of trees killed by the rise of the water over their roots—that since 1880, or possibly earlier, the water of many small lakes and ponds without outlet throughout the southern part of British Columbia has stood permanently or for prolonged intervals at higher levels than those that prevailed during forty or fifty years previously. This carries back the period of low water to 1840 or 1830. The water appears to be declining now. The lakes lie within the area between the Rocky Mountains and the Coast Ranges. Similar fluctuations have been observed by Mr. G. K. Gilbert in the Great Salt Lake. The phenomena possibly point to some secular change, the nature and causes of which are not known.

THE topographic and geologic maps of the United States are, in conformity with an act of Congress, offered for sale. They are prepared from actual surveys, and the topographic maps show all necessary physical and cultural details. Each sheet, sixteen and a half by twenty inches, is designated by the name of some principal town or prominent natural feature within the district, and covers one sixteenth, one fourth, or the whole of a geographical degree, according to the scale on which it is made. The sheets will be sold for five cents each, or, if the orders are for one hundred sheets or over, whether the same or different, for two cents each. The folios of the geologic atlas, containing the topographic, areal, economic, and structural geologic maps, with textual descriptions, will be sold at prices according to the size—usually twenty-five cents. Send postal or express orders, not stamps or checks.

H. BEAUREGARD is authority for the following information in the *Comptes Rendus*: Ambergris is a calculus which is developed in the rectum of the sperm whale. This calculus is composed of crystals of ambrine

mixed with considerable black pigment from the rectal lining and star-coral *débris*. When it is fresh it is of a soft consistence and its odor is not at all agreeable; but if preserved for several years away from the air, it loses this disagreeable odor and retains merely a delicate perfume *sui generis*, which gives it great commercial value. This change is due to a microbe for which the author proposes the name *Spirillum recti physeteris*.

LORD LISTER and Pasteur many years ago showed that the souring of milk and cream is due to a process of fermentation during which the milk sugar is converted into lactic acid, and that this is due to the activity of minute micro-organisms. It remained for Prof. Wilhelm Storch, of Copenhagen, however, to introduce the use of pure cultures of milk-souring bacteria in butter-making. Storch found that several kinds of acid-producing bacteria are concerned in the normal souring of cream, and he isolated three species that imparted especially fine flavors to butter. Other workers in this subject have been Professor Weigmann, of Kiel, in Germany, and Prof. H. W. Conn, of Wesleyan University. Now S. C. Keith announces in the Chemical News his discovery of a new flavor-producing bacterium which he calls *Micrococcus butyri-aromafaciens*. It is a micrococcus growing at 37° to 20° C. It liquefies gelatin slowly, but does not grow well on potato.

NOTES.

It is very curious and almost paradoxical, says M. V. Brandicourt, reviewing in *La Nature* the underground temperature observations made in excavating the great Alpine tunnels, to find underneath the eternal snows physical conditions like those of tropical regions. Under its frigid envelope of ice the *massif* of the Alps is nearly a hot furnace, and nowhere else in Nature can a more striking contrast between the intense cold of the higher peaks and the heat stored up in the depths of the soil be found. It is computed that tunnel borers under Mont Blanc would meet a temperature of 122° F. in the deepest part of the excavation.

It is suggested in the report of Prof. W. A. Hardman and Mr. Andrew Scott, on disease in the oyster, that the dread of germs may be carried too far. "After all," Professor Hardman says, "we do not want—even if we could get it—an aseptic oyster. The rest of our food—our milk, our bread and cheese, our ham sandwiches, and so on—are teeming

with germs, most of them harmless so far as we know, but some of them may be just as bad as any that can be in shellfish. If we were to insist on breathing filtered air and eating nothing but sterile food, washed down with antiseptic drinks, we should probably die of starvation or something worse, if we did not go mad first with the constant anxiety." The report holds that our object should be to get our oyster beds as healthy as possible, but not to insist upon conditions that would make it impossible to rear any oysters at all.

THE Hon. Carroll D. Wright, United States Commissioner of Labor, has been elected a member of the Institute of France, and an honorary member of the Imperial Academy of Science of Russia.

At the annual meeting of the Indiana Academy of Science the following officers were elected for the year 1898: President, C. A. Waldo, Purdue University; vice-president, C. H. Eigenmann, Indiana University; secretary, John S. Wright, Indianapolis; assistant secretary, A. J. Bigney, Moore's Hill College; press secretary, George W. Benton, Indianapolis; treasurer, J. T. Scovell, Terre Haute.

A STORY is told in the Electrical Review of London to the effect that Augurelli, in the sixteenth century, believing or pretending to believe that he had discovered the art of making gold, dedicated a treatise which he wrote on the subject to Pope Leo X. The Pope received him with much ceremony and spoke with an appearance of great cordiality, and he flattered himself that he was going to receive a very liberal reward. At the close of the interview Pope Leo took a large purse out of his pocket and presenting it to him said, "As you are able to make gold, I can not offer you a more useful and fitting present than a purse to put it in."

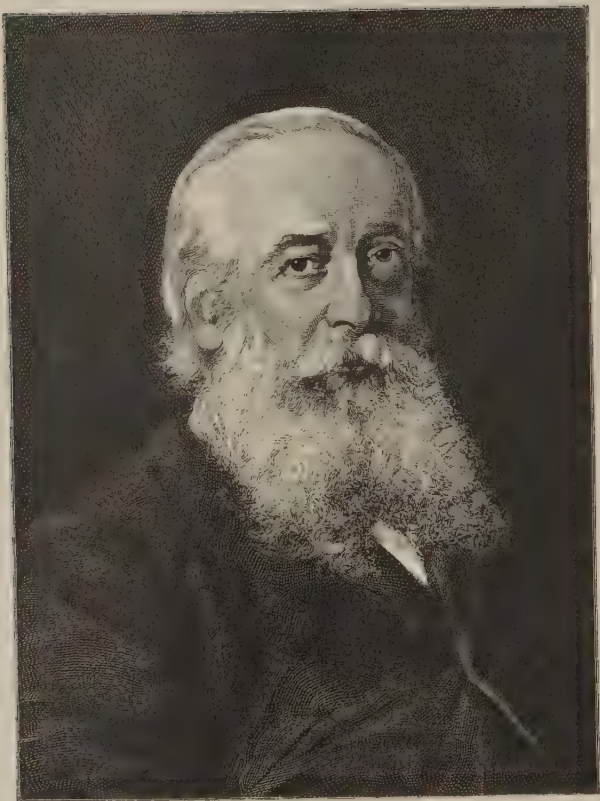
THE people living along the river Tura, in the Russian government of Tomsk, to collect the platinum that abounds in the river sands, hitch a sort of a plowshare to the rear of a raft. This plows up the water, as they express it, and the sands of the bottom are led into a wooden conduit, whence they pass into a tub furnished with pine branches, among which the metal settles by virtue of its high specific gravity. The exploiters are said to find this method of washing profitable.

THE carpet industry at Osaka, Japan, according to the British consul at Hiogo, gives employment to about ten thousand children and youth of both sexes from seven to sixteen years of age. The carpets are made of jute, with designs imitating those of Persia and Turkey. About four thousand eight hundred square yards of goods are produced a day.

THE Philadelphia Mycological Center is a club, of which Captain Charles McIlvaine is president, for the study and testing of mushrooms. Its second Bulletin, for September, 1897, gives descriptions, with the results of testings, of twenty-one species. Most of these species were found to be good eating, but cautions are given respecting a few of them. The "Center" seems to be prospering, for the Bulletin gives the names of fifteen new members in Pennsylvania, New Jersey, New York, and Massachusetts.

THE Hon. Ralph Abercrombie, meteorologist, whose death at Sydney, Australia, June 21st, has been mentioned in the Monthly, was born in 1842, and was always in delicate health. Having entered the British army in 1860, he was stationed at Quebec in 1864, and while there obtained leave of absence and visited General Grant. He was obliged to give up his commission in 1869, and after this the maintenance of his health became a serious care with him. His meteorological studies began at an early period, and his first book—*Seas and Skies in Many Latitudes*—embodied observations made by him while in the military station at Quebec. His most distinguished service to meteorology was probably the preparation, in conjunction with Professor Hildebrandsson, of Upsala, of the new classification of clouds, which was adopted by the International Meteorological Congress of 1896. He was author of works on the Principles of Forecasting, of the book on Weather in the International Scientific Series, and of many contributions to scientific societies. During his seven years of illness at Sydney he made grants of money for the production of essays on meteorological subjects, three of which have been published.

THE record of recent deaths among men of science includes the names of Arthur Kammernann, attached to the observatory at Geneva since 1881, in his thirty-sixth year; Ernest Giles, Australian explorer; Thomas Jeffrey Parker, professor of biology in the University of Otago, and author of works on biology, at Dunedin, New Zealand, November 7th; Prof. Francesco Brioschi, mathematician and president of the Accademia dei Lincei in Milan, December 13th, aged seventy-two years; James Holm, professor of physics in the South African College, Capetown, aged twenty-eight years; Dr. Oscar Stumpe, astronomer, at Berlin, aged thirty-five years; Dr. Eduard Lindemann, scientific secretary of the Observatory of Pulkova, Russia, in his fifty-sixth year; Prof. E. L. Taschenburg, author of contributions to Economic Entomology, January 20th, aged seventy-nine years; M. Ernst Bazin, inventor of the roller steamer; and Dr. Samuel Newth, formerly principal of New College, St. John's Wood, England, and author of books on natural philosophy.



CARL SEMPER.

APPLETONS' POPULAR SCIENCE MONTHLY.

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AN INDUSTRIAL OBJECT LESSON.

By S. N. D. NORTH.

THE past year was one of unusual disturbance in England, in the relations of labor and capital, and the chief of these industrial conflicts possessed a significance never anywhere surpassed. The lockout of the engineers—we call them machinists in this country—marks the new alignment of organized labor and organized capital—what may be called the secondary stage of the labor question—more sharply, more tensely, than ever before. A glance at the underlying causes of the engineering lockout will afford a clear conception of the form in which “the labor question” presents itself for the solution of the twentieth century.

There have been strikes that involved a larger number of workers, as the great coal strike of 1893, and the London dock strike; strikes that have lasted longer; strikes that have been costlier; strikes that have developed more bitterness of feeling. There has been no previous collision which, brushing aside all questions as to wages, reached down so closely to the root of the problem, and spread open to public knowledge the real essence of the difference which threatens the productive forces of modern times. The engineers' strike furnishes a concrete illustration of the immensity and the perplexity of the unsettled issue of modern industrialism.

Broadly speaking, labor strikes are of two kinds. The great mass of them, hitherto, have belonged in the simpler group, and have had to do with the wage question only; they are simple, however serious and complicated they may outwardly be, because they turn upon a single economic fact. When employers insist that certain rates of wages are necessitated by existing business conditions, and

the employed deny this, there is a definite fact at issue; and such strikes are coming more and more to be settled in accordance with what that fact is found to be. It is not often that a strike succeeds, when the employers are able to show that the wages demanded can only be paid by carrying on business at a loss. We can prognosticate with certainty about capital, that it will not carry on business indefinitely at a loss—if for no other reason, because it soon eats itself up. Another thing quite as certain is that capital will not indefinitely prolong a conflict with labor at a time when it is possible to effect adjustments by which it can continue to produce at a fair profit. These are two laws which experience has evolved out of this class of labor disputes.

The engineers' strike presented an entirely different phase of the labor problem. It was never a direct quarrel over dollars and cents; the question of wages, while indirectly involved, was subordinated to another, which, if we analyze it carefully, we shall find to be this: Which of the two parties in interest shall control the business that labor and capital jointly carry on? The labor problem in England has reached precisely this stage, and the engineers' strike was, in fact and in essence, a contest for the control of the management of the works, and the conditions under which these enterprises shall be carried on. This is a very broad way of stating the case, but it is essentially fair to both parties. It is always easy to recognize, in any labor dispute, the difference between contention for redress of legitimate grievance, as to wages or otherwise, and contention for control and direction and limitation over the management and conduct of manufacturing enterprises. This difference has distinguished and differentiated the engineers' strike from most of the great labor conflicts which have preceded it in England. It was, from start to finish, a contest over a great economic principle—a principle which lies at the foundation of modern industrialism. The whole long struggle has been singularly free from any collateral questions tending to hide or minimize its real significance. Both sides understood it; both prepared for a battle royal; both were ready to wage it to the bitter end; and thus it has been a dogged, determined, remorseless test of endurance over a vital issue of business economics, while the world looking on has only vaguely sensed its true meaning, or has missed it altogether.

It is impossible not to admire the splendid fidelity with which the engineers carried themselves through the six months in which they locked horns with their employers. Of all the labor organizations in England, the best equipped for such a struggle, both in men and in money, was the Amalgamated Society of Engineers. The organization is quite the aristocracy of English trade unionism.

The machinist trade involves a high grade of intelligence, and its skilled operatives earn the best wages going. Their organization is one of the oldest, most compact, and best disciplined in the island. Its leaders are men of brains, discretion, and nerve. In deliberate preparation for this great contest, the organization had accumulated a maintenance fund of nearly two million dollars. They have been sustained by many evidences of popular sympathy, including generous contributions to their funds, and they have been careful to so conduct themselves as to win rather than alienate public support.

They have regarded themselves as the chosen champions of what is known as the "new unionism," and they knew that the whole status of trades-unionism in the immediate future of English industry turned upon their success or failure. It has thus been, on the part of the engineers, something in the nature of a vicarious struggle. They were giving battle for an abstract proposition, deemed by them vital to the future well-being of organized labor, not merely or chiefly their own group, but all branches of organized labor in England and everywhere. However widely we may differ with these men, however impossible and impracticable we may regard their demands, we must feel a genuine admiration for the grit and doggedness with which they have carried on a battle which for many months past has been seen to be hopeless. If they have failed, and failed disastrously, it is only fair to say for them that they have failed through no lack of courage or endurance.

On the other hand, let us look at the attitude of the employers, and the reasons which underlie it. From their point of view it was a struggle for existence, for the right to continue the industries in which their fortunes and future are embarked. To fully understand this it is necessary to explain the ostensible and the real reasons of the lockout. It was precipitated on July 24th last, by the formal demand of the London branch of the engineers for the eight-hour day. This demand was the logical aftermath of the successful strike of the engineers for the nine-hour day back in 1870; the Amalgamated Association having been successful in that movement, it was the natural agency through which the eight-hour movement, upon which English trades-unionism has now resolved, should be pushed to an issue. The original demand for eight hours was confined to the London shops in accordance with the well-known trade-unionist plan of campaign. The iron masters of the provinces, realizing that the success of the movement in London must inevitably extend the eight-hour day to all the iron establishments of the kingdom, made common cause, and combined to lock out their employees pending the settlement of the London difficulty. The collision being inevitable, they determined to force into it certain other ques-

tions, which the engineers had shrewdly kept in the background, but which were latent in the eight-hour movement, and, from the employers' point of view, inseparable from it—questions which have long been irritating, and the conflict over which could not long be postponed.

In the judgment of the iron masters these questions were lifted far above the range of a mere labor dispute, and involved the broad and national question of the continuance of Great Britain in the race of international competition. We need not enlarge upon the reasons which convince so many Englishmen, and particularly those who are in the thick of the fight, that England's industries and commerce, not merely foreign but domestic, are seriously threatened by the competition of the continental manufacturers, as well as those of the United States. They cite the longer hours, the lower pay, and the superior technical education of continental workmen as three reasons why the products of the latter are gradually superseding goods of English origin in the world's neutral markets. They cite the larger product from improved machinery, and the superior application of this machinery, both on the continent and in the United States, as constituting economic advantages against which they are no longer able to successfully contend. They urge that in the long run these superior advantages mean the gradual surrender of Great Britain before a competition ever closer and fiercer, in which a fraction of difference in the cost of production is sufficient to turn the scale. From their point of view the introduction of the eight-hour day, as against ten and even twelve hours on the continent, would mean industrial *hari-kari*.

But the complaint reaches further: it insists that English trades-unionism, as developed in the iron trade particularly, is a handicap to industrial progress which is bearing fruit in the continual loss of trade, and the extinction of profits in the conduct of business. Trades-unionism has aimed steadily and successfully at a larger and closer control over the conditions under which work is done in the shops. The masters had lost control over the management of their own business, and, no longer able to adapt themselves to modern methods and economics, they found themselves in a state of dry rot, extrication from which was only possible by heroic measures.

Doubtless there is a degree of exaggeration in this picture, as drawn by the iron masters. Nevertheless, it is true that English trades-unionism has become so strongly organized and entrenched, and has followed lines of policy so aggressive and so potent, that it has long been an open question in England whether the internal management of the shop is not more under the domination of the union than of the employers. Until a comparatively recent date the conse-

quences of such a situation have not been strikingly apparent. But the mechanical advances in all branches of iron manufacture during the last few years have been marvelous, and the consequent economies equally marvelous. The trades-unionists have carried on a silent, secret, and to a large degree a successful movement against the efficient introduction of these new methods in the shops under their control. There is no good reason to doubt the statement, repeatedly made by the iron masters, that Great Britain is, in consequence, far behind the competing nations in many forms of iron manufacture, in efficiency of equipment, and in product per man.

So far as this fact is due to English trades-unionism, it must be regarded as a triumph for that organization; and it is somewhat difficult to get at the philosophy by which organized labor justifies itself in standing athwart the pathway of mechanical progress. At its basis undoubtedly lies the inherited antipathy of the English workingman to labor-saving machinery. He possesses this antipathy to a degree and extent unknown in any other country. It has come down to him through the generations, and its tenacity is one of many evidences of the narrowing influence of insular conditions. The time has long since passed when this antipathy takes on the form of open violence, the smashing of machines, the burning of mills, and the maltreatment of inventors—things common enough in the days of the Luddites, seventy-five years ago. The modern manifestation of this inborn and inherited antipathy to labor-saving machinery is a species of moral boycott—indefinite, intangible, indirect, felt rather than seen. It frequently takes the form of union regulations, under which the mechanic restrains himself from turning out more than a given product in a day, irrespective of the possibilities of the improved machine he operates. The engineers' strike has inspired a great mass of literature showing how the enforcement of these regulations has tended to limit output, and thus handicap English manufacturers in their struggle against foreign competitors. Here is one of many illustrations given by Colonel Dyer, the chairman of the Federated Employers, in a recent magazine article:

We have a very large boring machine at Elswick ; this boring machine is eighty feet long. We do very rough work on it—i. e., we take the center out of the shaft by means of a trepanning tool. We took the center out of a shaft the other day seventy feet long. The whole center was trepanned out. We selected a man for working the machine ; a man came round, a very intelligent-looking man, and that was all we had to judge by—we can not ask him what society he belongs to. We asked him if he could work this machine. He said of course he could. We put him on the machine, and he worked it about six or seven months. *We could never get more than four or five inches an hour out of the machine.* We pressed him,

and begged him to do better ; we were very busy at the time, but we could never get above four. At last we could go on no longer ; we knew that the machine should do more, and we said the machine was not giving satisfaction, and he was discharged. We then selected a boy, a very intelligent-looking young fellow, but he knew absolutely nothing about machines. We said, " Will you learn this machine ? " He said he was most anxious to do so. He buckled to, and the lad in three weeks had *increased the production of the machine up to six inches an hour, and the other day I got a note that the machine was doing eleven inches an hour.*

Hiram S. Maxim, the great gun maker, who has had experience in manufacturing in three countries, declares that a given amount of labor in the iron trade produces a smaller product in England than in France, Germany, or the United States; and that a given machine has a greater productive capacity in each of these countries, and particularly in the United States, where the system of payment by the piece generally exists. The Amalgamated Society has generally successfully resisted the piece-payment system, and has managed in many other ways to practically control the internal management of the shop.

In a word, the purpose of the manufacturers has been to so change the basis of their industry that they can increase production by reducing costs, not through reduced wages, but through the more complete utilization of modern mechanical inventions. They have insisted that the individual workman would, in consequence, earn much higher wages. The movement on the part of their employees was one to limit production by the shorter working day and by the increased cost of increased overtime work at overtime wages. The ends aimed at were diametrically opposite, and the intensity and the prolongation of the struggle are thus explained. It was an issue which admitted of no compromise. A truce might, indeed, have been patched up, and the battle declared a draw; but any conclusion short of the complete surrender of one side or the other would have left the vital issue as unsettled as at the start.

As that issue has been stated, the impartial student finds it difficult to understand why it should exist at all. If the iron masters are right in their contention that reduced costs of production, through greater machinery efficiency, are necessary for the preservation of English manufacturing against foreign encroachment, the welfare of their workmen is as vitally involved as their own. This is only another way of stating the time-worn truism that the interests of capital and labor are identical, in any true analysis of their relationship.

But the English trades-unionist does not see the matter in any such light; nor is his point of view at all obscured. Apart from the latent antipathy to labor-saving machinery, which is not avowed, is

the dominant idea, strongly accentuated in all unionist literature, that there is a given amount of work to be done in this world, and not enough to go around; that the unionist, by arbitrarily limiting individual output, can thereby increase the demand for labor, and thus increase the number and the wages of the employed. This postulate of trades-unionism is as old as trades-unionism itself. It has a basis in humanitarianism which renders it praiseworthy as an abstract proposition. But it is an abstraction which belongs to the past century; which had its origin in the days when England held undisputed supremacy in the industrial world, and no combination of events seemed likely to dislodge her from that vantage. It has become an anachronism, just as England's supremacy has become a myth; and the same causes have produced the two results. If the commercial isolation of nations which formerly existed continued, the postulate of the engineers would be understandable. If English workmen still made machines for all the world, these hard-headed workmen might well have staked their all upon such an issue with hopeful hearts. But the direct results of their six months' idleness help to illustrate how far beyond their position the world has moved. The suspension of work has been an enormously expensive affair, not merely to the masters and the men, but to the nation. A great hole has been made in British commerce, and it will never be filled. Orders for machinery which the idle works in England could not fill have gone to the continent, and in many instances have come to the United States. The work has been done as well as in England; in most instances it has been done cheaper than England could have done it. The trade thus lost has gone for good. The engineers have not merely lost six months' wages; they have seriously crippled the wage-paying power of their industry. From their own standpoint, instead of increasing the opportunities for labor in England, they have reduced them. The abstract thing they fought for they have lost; but their ultimate loss would have been even greater had they won their battle instead of losing it.

The difficulty with the English trades-unionist view, then, is the failure to realize that the march of civilization has made the labor question an international question. Their contest was not so much with their employers as with their fellow-laborers in other lands. It is the competition of the latter which makes it impossible for the English iron masters to grant the eight-hour day, or to drag behind the rest of the world in the application of labor-saving machinery.

One writer, commenting upon the outcome of this strike, declares that trades-unionism has lost by its defeat all that it has gained by fifty years of constant contest. On the contrary, it would seem possible that it may gain, by reason of its defeat, a clearer con-

ception of the real forces against which labor has to contend, in the realignment of industrial conditions. If this shall come, the gain will be greater than the loss. At the bottom of the engineers' movement was a remarkable misreading of the operation of economic cause and effect. The labor question of to-day is not the labor question of fifty years ago; it turns now on broader considerations than those which local environment can control. It is no longer a question that has chiefly to do with the relative share of the proceeds of industry which shall go to labor and to capital. In the preliminary stages of the evolution which has brought the factory system to its present perfection, this was practically the only question which underlaid the strike; and it may safely be conceded that in many instances of conflict which arose over this question the strikers were right, even when they failed. The law of industrial competition under which this evolution has progressed has so operated that profits have decreased as wages have increased; and so rapid has been the evolution, so strenuous has become the competition which the increase of capital has brought about in all industries and in all manufacturing nations, and more particularly in England, that the point is already reached where the problem has come to be largely one of how to keep the earnings of capital and the earnings of labor in that status of equilibrium which shall be equitable to both. It is a development in industry which was not dreamed of when trades-unionism was getting under way; a development the end of which no man can to-day foresee; a development which has brought about an increase in the producing capacity of the world which has far outstripped the increase in population, and with which consumption can keep abreast only in spasms and by jerks. Under these new conditions, wherever and whenever an oligarchy of labor succeeds in so fortifying itself that it can establish terms under which it is no longer possible for the capital employing it to earn a fair return, then it will have killed the goose which lays the golden egg.

The English engineers resolutely shut their eyes to this aspect of the case. From their point of view it had nothing to do with the controversy. From the masters' point of view it was all there was of the controversy. To the masters it was purely an economic question; to the engineers it was one which vitally involved the social advance of the wage-earning classes. It is not necessary to believe that this social advance and economics are hopelessly at variance in the present stage of industrialism. It is better to say that while employers have much to learn from the humanitarian point of view, trades-unionism is equally in need of instruction from the economic point of view.

Does this great strike throw any new light upon the possible solu-

tion of such troubles for the future? Unfortunately, the method of settlement of labor disputes by arbitration has not gained prestige from the experience, but has rather lost it. Arbitration was never more advantageously introduced than when the initiative was taken in the engineers' strike last November by the Right Hon. T. C. Ritchie, president of the Board of Trade, and one of the most influential members of the Salisbury Cabinet. It was left for him to arrange the "*pour parlers*" of the conference, and the moral influence outside the committee room for a settlement was tremendous. The only result was to strengthen the position of the engineers, for they shrewdly consented to submit to their union certain propositions made by the employers, and they were rewarded by a vote of forty thousand in opposition, with only one hundred and fifty in favor of acceptance. If this had been purely a question of wages, arbitration would have doubtless settled it. Wages involve questions of fact, and conference and discussion are increasingly successful in bringing employers and employed together on a basis which knowledge of the facts shows to be mutually equitable. But bound up in this controversy was the whole question of the economic conditions of modern industrialism, both national and international, as well as the question of that indefinite, indefinable line where the rights of the employer end and those of his workmen begin. The more the conference discussed these questions, the farther apart the parties to it found themselves. They are beyond settlement, except a temporary armistice, by any scheme of arbitration under any auspices, private or governmental. There is no middle ground, in such a dispute as this one was.

But time and the sequence of events will work out a solution, as has been the case with all the great problems which have successively confronted civilization. We can not see into the future, nor can we even vaguely outline the ground upon which employer and employed will ultimately agree to live at peace with each other. But we need not despair of its finding, nor need we fear that it is hopelessly distant. The world moves faster in a modern decade than in three centuries of the middle ages. A hundred years ago the world did not dream of such a thing as the labor question in the form in which it now presents itself. This present phase is only a transitional episode of conditions quickly developed, but not yet sufficiently advanced to have worked themselves into their final forms. Every great controversy like the engineers' strike throws a flood of light upon the problem by bringing all its elements into clearer relationship, and unconsciously leads the world a step nearer to the ultimate solution. An all-sufficient reason for this hopeful view of the matter is the fact that larger knowledge is always coming to

those who are parties to these controversies. It is impossible to doubt that the wide diffusion of education is always helping to clarify the situation. It has done much already to relieve the industrial strike of its uglier features. Riot and bloodshed now rarely mark it where the parties to a contest are men of average intelligence and education, like the English engineers. So the evolution will advance, step by step, and point by point, until the time shall come when exact justice to all concerned, in harmonious accord with the economic laws of modern business, shall have worked itself out.



THE ELECTRIC TRANSMISSION OF WATER POWER.*

By WILLIAM BAXTER, JR.

EVER since the electric light and power industry began to be a factor in the economic affairs of the industrial world, its adaptation to the work of transmitting the power of waterfalls to more or less distant points has been the dream of those who realize its vast possibilities, and who believe that the ingenuity of man is equal to the task of overcoming any difficulties that may be encountered in attempts to find a successful solution of the problem. For more than twenty years those who may be called electrical enthusiasts have prophesied that the day would come when the power of Niagara would be delivered at the door of the consumer in the city of New York, and capitalists have not been lacking who would have provided the means for carrying out an undertaking of this kind if they had been given the proper assurance by electrical engineers of prominence that the results sought for could be attained. Such assurance, however, could not be given; for, although it is known that there is no difficulty in the way of accomplishing such a result theoretically, the practical development of the art has not reached a stage that would render the realization of such an undertaking possible.

To transmit power by means of electric currents over long distances, without suffering too great a loss in overcoming the resistance of the conducting wires, it is necessary to make use of a high electrical pressure, the effect of which is to render very difficult the perfect insulation of the line, so as to prevent the escape of the current. The greater the distance to which the current is transmitted, the greater must the pressure be to keep the loss of energy and the cost of wire within permissible limits; hence, when the pressure

* For the illustrations in this article we are indebted to the kindness of the General Electric Company.



LOOM ROOM, PONTIAC MILLS, TAFTVILLE, CONN.

required becomes as great as can be insulated with certainty in the present state of the art, the distance of transmission is increased to the utmost limits attainable in practice. Until some more perfect means for confining the current is devised, greater results can not be reached. With our present knowledge of insulating materials, and our methods of applying them, it would be practically impossible to transmit energy over distances as great as from New York to Niagara, but it does not follow that the accomplishment of this result will never be witnessed; it is a possibility of the future, that may not come for a century or more, or may be realized within the next few years.

Although the achievement of such stupendous results as the transmission of power over several hundred miles is not within our present reach, it is possible to bridge distances of twenty or thirty miles, and the accomplishment of this much has been considered entirely practicable for several years. It was on this account that the Niagara power plant was started, the object being to supply the city of Buffalo and other places within a radius of twenty-five or thirty miles. This undertaking, owing to the magnitude of the power available, has attracted world-wide attention, and is probably regarded by the vast majority of people as the only work of any importance in this line that has been attempted. This, however, is far from being true; it is the largest, and will undoubtedly always remain such, since the source of energy is practically unlimited, but there are several other very large installations, and in some of these the distance of transmission from a mile or so up to thirty-five miles. place being nearly double that distance.

A fair idea of the extent to which this branch of the electrical industry has been developed may be gained from a consideration of the fact that one manufacturing concern alone has sold over two hundred thousand horse power of machinery for this purpose within the last four or five years, their sales for 1896 being over seventy-five thousand horse power. The great increase in the business during the past year, in the face of a general stagnation in all other lines of industry, is a very clear indication that what has been done in the past has been entirely successful—so much so as to inspire an amount of confidence sufficient to overcome the apathy or unwillingness to embark in new undertakings so manifest in all other lines of business.

The total number of water-power transmission plants in successful operation in the United States in addition to the Niagara installation is over two hundred. The amount of power transmitted ranges from less than one hundred horse power up to twelve thousand, and the distance of transmission from a mile or so up to thirty-five miles.



STEP-DOWN TRANSFORMERS IN SUBSTATION. FOLSOM-SACRAMENTO TRANSMISSION.

To give an idea of how near to New York city work of this kind is being done, we may mention a few installations.

There is one at Springfield, Massachusetts, where about nine hundred horse power is transmitted to a distance of over six and a half miles; one at Bondsville, Massachusetts, having a capacity of about thirteen hundred horse power; and another at Fitchburg, Massachusetts, of about four hundred horse power. In this latter plant the distance of transmission is only two and a half miles, but as an offset to it, in distance as well as amount of power, may be mentioned a plant in Quebec, Canada, where over two thousand horse power is transmitted eight miles. At Concord, New Hampshire, there is an installation of several thousand horse power capacity, which is transmitted to a distance of five miles.

At Hartford, Connecticut, there is a plant of about fifteen hundred horse power, which is transmitted a distance of eleven miles; at Baltic, Connecticut, about fourteen hundred horse power, and in several places in the New England States, installations ranging from two hundred to one thousand horse power can be found. At Hookset, New Hampshire, there is a plant of three thousand horse power, which is transmitted about eleven miles. In the State of New York there are plants at Gouverneur, Canandaigua, Tonawanda, and many other places.

The plant at Baltic, Connecticut, furnishes power to operate one of the Ponemah mills at Taftville, about four miles and a half distant. The interior of this mill is shown in the illustration on page 731. In addition to operating this mill it furnishes power to run the Norwich street railway.

The Ponemah mills, two in number, were originally operated by three turbine wheels and two steam engines, the water power not being sufficient at all times of the year to meet the requirements. In 1892 the Norwich Street Railway Company was changed from horse to electric, and made a contract with the Ponemah Company to furnish the power. The road, which started in a small way, soon increased, and the extra load proved too much for the three turbines and the two engines, located at the mills, to carry. It was then decided to develop and utilize the water-power privileges owned by the Ponemah Company some distance up the Shetucket River, and transmit it by means of electricity to the mills and the railway. The old dam was enlarged, and three turbine wheels, having a combined capacity of nearly two thousand horse power, were installed. These are belted to a line shaft from which the electric generators are driven. At the end of the line the current is used to operate one of the mills, to furnish the necessary light, and to operate the railway already referred to, and, in addition to this, two locomotives used to

haul freight, one being of five hundred horse power and weighing thirty tons.

The current generated at the power station is of the alternating type, and undergoes one or two transformations before being used at its destination, but the operation of the apparatus is so perfect that this power, generated four and a half miles distant, can be used in connection with the steam engines at the mills, and each one will do its proper share of the work.

A plant of twelve thousand horse power is now being built at the Lachine Rapids, about five miles from Montreal, Canada, and, although it is not larger than some of those in operation, or in process of construction in the western part of the country, it may in time become such, as the source of power is very great, and increases can be made as fast as the demand calls for them. At Trenton, Canada, there is a plant of about nine hundred horse power which is transmitted a distance of twelve miles.

Within the past few months it has been found by the investigations of engineers that a very large power can be obtained near the town of Massena, in the State of New York. At this point the St. Lawrence River descends about one hundred feet in a few miles, going over the Long Sault Rapids; but the Grass River, which runs nearly parallel with it and only about three miles distant, drops but fifty feet. As a result of this difference in the fall of the two rivers, the St. Lawrence is fifty feet higher at the head of the rapids than the Grass. By cutting a canal of sufficient size at this point the water of the St. Lawrence can be diverted to the Grass and over the fifty-foot fall, thus developing an amount of power limited only by the size of the canal. The estimates of the engineers who have surveyed the site is that as much as two hundred thousand horse power can be obtained. The work of development is under way, and if it is carried through on the scale proposed will only be surpassed in magnitude by the Niagara plant.

The largest water-power transmission in the South is probably one located at Pelzer, North Carolina. At this place nearly four thousand horse power is utilized, and transmitted a distance of about three miles, where it is used for the operation of extensive cotton mills.

There are many transmission plants in different parts of the West, the largest of which is, perhaps, at Minneapolis, where the amount of power utilized is over ten thousand horse power; but none of these is of as much interest as those to be found on the Pacific slope, owing to the fact that with few exceptions the distance of transmission is short. In the latter section, however, the possibility of using electric transmission for great distances is better demon-

strated than anywhere else. At Redlands, California, there is a plant that delivers the power at a distance of over twenty miles. At Fresno, California, over two thousand horse power is transmitted about thirty-five miles. A noticeable feature of this last-named installation is the enormous height of the water fall. The head is fourteen hundred and ten feet, which is the greatest in use, commercially, in any part of the world. What such a head really means can be realized when we state that the pressure of the water amounts to over six hundred pounds to the square inch. The distance of transmission, thirty-five miles, is also the longest now in actual use, but it is less than that of the Pioneer Electric Company of Ogden, Utah, which is in process of construction. The work now under way at this latter place will transmit power to Salt Lake City, a distance of thirty-six miles, but it is intended to carry the line to mines thirty miles beyond this point; therefore, when the whole system is completed, the total distance of transmission will be sixty-six miles.

The Folsom-Sacramento power-transmission plant is one of the most noteworthy of those so far installed, as it serves to show clearly the great benefits derivable from the use of electricity. The power station is located at Folsom, on the American River, where one of the largest water powers in the State of California is available. The first attempt to utilize this power was made as far back as 1866, but owing to the conditions then existing was necessarily limited in its capacity to the demands of the immediate vicinity. The work as at first conceived embraced a dam across the river, the water to be used in part for power and in part for irrigation purposes. The plan was modest in its proportions, and remained so for many years; but the development of electric transmission has magnified it into an undertaking of vast magnitude, embracing the development and transmission of over five thousand horse power when the full capacity is reached. The dam now used is six hundred and fifty feet long and eighty-nine feet high, and has a storage capacity of about thirteen million cubic yards. The water is conveyed to the water wheels by canals two miles long and fifty feet wide by eight feet deep.

The power station in which the water wheels and the electric generators are located is so designed that the latter are connected direct with the former, being mounted upon the same shafts, but separated from each other by a stone wall, through which the shafts pass. The electric current developed in this station is transmitted to Sacramento, a distance of about twenty-five miles, and is there received in a substation, the interior of which is shown on page 733. The current coming into this station from the power plant is of a very high pressure, entirely too high for commercial use, and there-

TOPOGRAPHICAL MAP OF

The Stalls, Big Cottonwood 2800 Horse Power Water Right

Leased to the Salt Lake City

Big Cottonwood Power Co.

Surveys, Designing and Drawing by

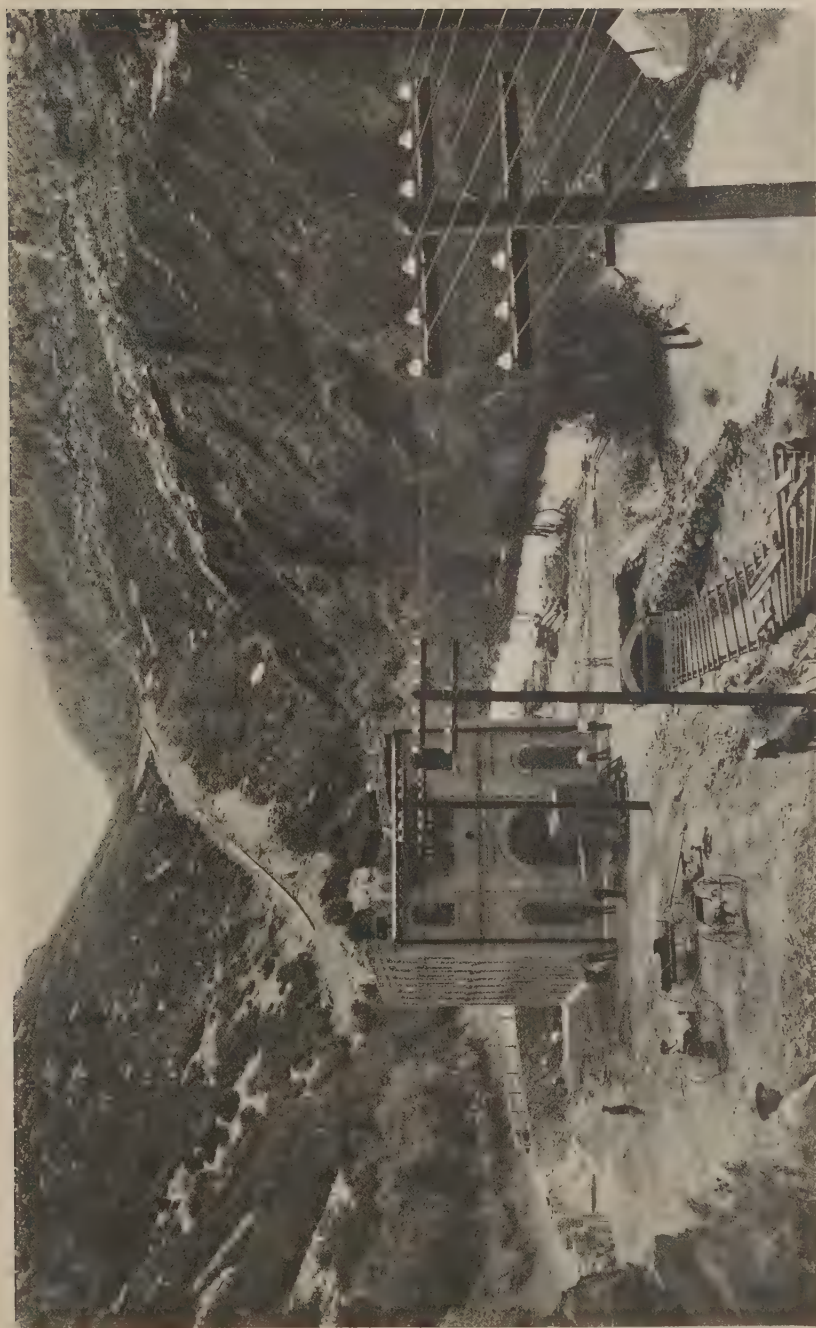
FRANKLIN, 635
1711 10th St. S. E.



fore has to be reduced by being passed through the machines shown in the illustration, which are called step-down transformers, their office being to reduce the pressure of the current. These transformers in reality do not reduce the pressure of the current; what they do is to generate a second current, by the aid of the energy derived from the first, of a much lower pressure. The power of the substation is to be used for all purposes, for "arc" and incandescent lighting, for driving stationary motors, and for the operation of electric railways.

The Big Cottonwood Power Company has about completed the construction of an important plant to utilize the water power of the lakes in the Wahsatch Mountains, and distribute it in and around the vicinity of Salt Lake City. These lakes, which empty into the Big Cottonwood Cañon, lie at elevations above the sea ranging between eleven thousand and thirteen thousand feet; therefore the total amount of power available is very large on account of the enormous fall. The Big Cottonwood Company controls a fall of about one thousand feet, but in the present installation will only use about four hundred feet. The water is confined in a reservoir, as shown in the topographical map on page 737, and is conveyed by pipe line to the power house, as is shown quite clearly in the illustration of the site of the latter on page 739, where the pipe is seen in the background, descending between the mountains. To guard against an accidental giving way of the reservoir, as well as to render it possible to empty it when desired without interfering with the operation of the plant, the pipe line is carried along the bottom to the upper end of the reservoir, where it connects with the main source of supply. By closing one gate and opening another, the water may be drawn from either point, as occasion may require.

The capacity of this plant is about twenty-five hundred horse power, which will be distributed at a distance of about fourteen miles. The water wheels are mounted directly upon the shafts of the electric generators, as can be seen from the illustration of the interior of the power station shown on page 741. The generator in the foreground is not provided with a water wheel; the only part of this apparatus visible is the water pipe under the shaft, between the two bearings. This generator was not completely mounted when the photograph was taken, but the two machines in the background, it will be noticed, are provided with water wheels, which are mounted on the shaft in the space between the two bearings, which in the front generator is uncovered. The simplicity and solidity of this apparatus are very striking, and, being one of the latest installations, show clearly the perfection to which machinery of this class has been carried; and from the fact that the capacity of



POWER HOUSE OF BIG COTTONWOOD POWER COMPANY.

each generator is about six hundred horse power, its compactness is also apparent.

There are any number of other power-transmission plants in this country, a description of which would prove interesting not only on account of their magnitude, or the distance to which the power is conveyed, but also on account of their revealing the vast amount of engineering skill displayed in surmounting difficulties that have been contended with; but the examples described in the foregoing are sufficient to show the enormous strides that are being made in this field, and yet the general public is almost wholly unaware that anything is being done except in an experimental way.

The electric transmission of power is not confined to this country by any means; plants of very large proportions can be found in almost every quarter of the civilized world, and in some places not specially noted for their civilization. In Mexico there are several installations, and no doubt there would be more if it were not for the fact that there is a scarcity of large streams and rivers in that country; therefore, although its mountainous conformation would lead to the conclusion that waterfalls are numerous, as a matter of fact those where the power available is sufficient to warrant its utilization are very few.

The principal installation in Mexico is at Pachuca, one of the most important mining districts in the country. The power plant is located at Regla, which is about twenty-three miles distant. The capacity of the plant is over three thousand horse power.

There are several plants in South American countries, quite a number in Africa, in Australia, in Asiatic countries, and also in Europe. The Jungfrau Mountain Railroad in Switzerland, which has been called the trolley to heaven, will be operated by power derived from the Black and White Lutschine Rivers, in Burglauenen and Lauterbrunnen. This road, which is about finished, ascends to one of the highest peaks of the Alps, one which heretofore has only been accessible to those of sufficiently vigorous constitutions to make the ascent on foot.

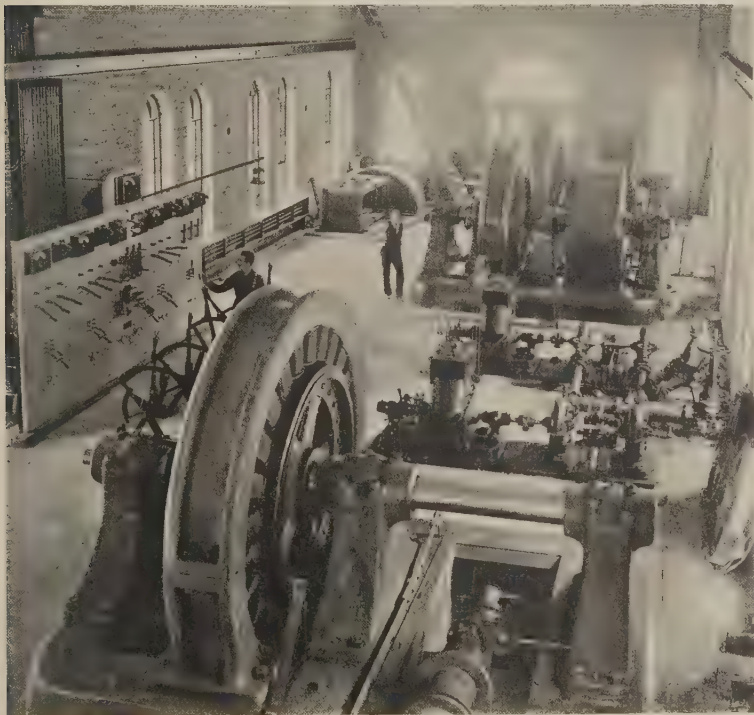
The Geneva water power is utilized to operate electric railways, electric lights, and to some extent for the development of power for industrial purposes. The distance of transmission at this place is about twenty miles.

Other installations in Europe of importance that may be mentioned are Rome, Italy—distance, about eighteen miles; amount of power, two thousand horse power, which is being increased to nine thousand; Davos, Switzerland; Schöngesung, Germany; Lauffen to Heilbronn, Germany; Zurich, Switzerland, and many others.

The longest transmission ever undertaken was an experimental

one between Lauffen and Frankfort, during the exposition at the latter place some years ago. This distance is one hundred miles, and, although the work was experimental and only intended to show what could be done, it was entirely successful, notwithstanding that the amount of power transmitted was only three hundred horse power.

From the few examples given in the foregoing paragraphs it can be seen that the electrical transmission of water powers to points where they can be conveniently utilized has passed far beyond the



INTERIOR OF GENERATING STATION. BIG COTTONWOOD POWER COMPANY.

experimental stage, and that the business of supplying apparatus for such purposes has already assumed large proportions, with every prospect that before long it will be a very important, if not the most important, branch of the electrical industry.

A contemplation of the results that may follow development along this line must lead to the conclusion that manufacturing centers will be materially changed. In many kinds of industry power is used so extensively that its cost is an item of the greatest importance,

and concerns engaged in work of that class will in many instances find it to their interest to locate where the energy of waterfalls may be available at low rates. The successful operation of the Niagara plant has had the effect of attracting to that section of the State several enterprises that require power in large quantities, and it is more than probable that, before many years pass by, Buffalo and the surrounding country will become an important manufacturing center. What is true of this case will be equally true of many others, and, while established enterprises may not remove from their present location, those started hereafter will undoubtedly be guided by the relative cost of power at different points, in connection with the advantages and disadvantages arising from the location of the power center. Thus, as the South is the source whence all the cotton comes, it would be natural to assume that manufactories in this line would locate in that section at points where water power can be obtained convenient to the cotton fields. That such localities can be found is quite evident, since, according to the census of 1880, the power available along the Chattanooga River is not far from one hundred thousand horse power, and along the various rivers of North and South Carolina, Georgia, and Alabama three or four times this amount can be obtained. All over the West and Northwest extensive power sites are to be found, and in time many of them will be rendered useful, and will form the centers of manufacturing districts, thus gradually augmenting this line of industry in sections of the country that at present are principally agricultural.

For several years to come it is very probable that efforts will be confined to the utilization of large units, but gradually the cost of installation and of operation will be reduced, and then smaller powers will be considered profitable. Following along this course of reasoning we may naturally conclude that, eventually, even farmers may be able to render available the energy of small streams passing through their possessions, and the future rural generations may use the electric motor to do the work around the farm that at the present time is performed by animal power.

THE name America for the western continent is said to have been proposed by Martin Waldseemüller, in his *Introduction to Cosmography*, published in 1507; but the exact time when it first appeared in a map is not precisely known. The earliest instance so far has been discovered by Professor Elter, of Bonn, in a manuscript map by Henricus Glareanus, dated 1510, in which the legend "*Terra America*" is attached to South America. Glareanus, born in 1488, became German poet laureate in 1512, and a professor at Freiburg in 1529. He has left what is probably the earliest circumpolar map in existence. In his map of America, North America is separated from South by a strait, and is represented as forming part of Asia.

CRIMINAL ANTHROPOLOGY IN ITALY.

BY HELEN ZIMMERN.

"Enemy" ye shall say, but not "wicked one"; "diseased one" ye shall say, but not "wretch"; "fool" ye shall say, but not "sinner."—F. NIETZSCHE.

IF we were asked to name in what particular Italy stands to-day quite head and shoulders above her fellows, we should unhesitatingly say in the science of criminal anthropology. This is an essentially Italian study, whose origin we discover as early as 1320, when the King of the Two Sicilies decreed that no one should be permitted to practice medicine who had not studied anatomy for at least one year. After this, in the fourteenth century, we find men who devoted themselves to the study of skulls, thus laying the basis of the science of craniology. It was Italians, therefore, who initiated this science, and to Italy has been reserved the proud place of bringing it to its high development in the nineteenth century, even though the discoveries of Darwin, which gave it a fresh impetus, date from England. Beyond question the peninsula is at the head and front of all studies connected with criminal anthropology, and not of criminal anthropology only, but of all cognate sciences connected with crime and the criminal.

To the Italians belongs the merit of reviving the study of a question with which philosophy, law, and medicine have always been occupied. It has been well remarked that whenever philosophical studies have free expansion, that whenever the desire to safeguard society, the spirit of toleration, the methods of ameliorating the fate of the guilty, have been studied by thinkers, their conceptions have eventually conquered public opinion. It is to the glory of Italy, the land where Roman law, the foundation of modern law, was born, that it has again put into the crucible this problem of criminality, and that it has proceeded to the study of this problem by the only truly scientific method—namely, that of studying the psychology of criminals and their pathological abnormalities. It will be its distinction to have declared against illusory enthusiasms, and to have founded a science which will contribute to the more efficacious protection of society. The recognized chief of this Italian school is Prof. Cesare Lombroso, of Turin, who has illustrated his theories by a number of remarkably able and interesting books. Until quite recently, to the world at large, the criminal figured as of the Bill Sykes type—and who, reading *Oliver Twist*, has not shrunk with horror on perusing the intimate drama of the ruffian's mind after the brutal murder of the faithful Nancy? These things move us as the highest efforts of Dickens's imagination. Bill Sykes was written in prescientific days.

It is instructive to turn from him, and the class of melodramatic ruffians of whom he is but an example, to the criminals dispassionately laid bare in mental, moral, and physical dissection by Lombroso and his fellow-workers. Certainly no such type as Bill Sykes, a projected image of the novelist's brains, coinciding with a highly strung nervous system, is to be found in the gallery of habitual malefactors presented to us in the *Uomo Delinquente* and other books. Habitual malefactors, according to Italian students, are a class apart from other men, a distinct species of "genus *Homo sapiens*," must be judged by special standards, and must by no means be informed with the feelings of normal men. Herein consists the fundamental basis of the new science of criminal anthropology—a science which bids fair, in spite of conservative and clerical opposition and even of ignorant ridicule, to modify profoundly our present manner of considering and treating these enemies and pests of society.

"Criminal anthropology," says Signor Sergi, one of the ablest exponents of the new system, "studies the delinquent in his natural place—that is to say, in the field of biology and pathology. But it does not for that reason put him outside the society in which his criminal manifestations occur, for it considers human society as a natural biological fact, outside of which man does not and can not live. As normal anthropology, like other biological sciences, studies and observes the individual in his natural *milieu*, and finds that this *milieu* is double, physical and organic, and under this double aspect sees him develop and act, so criminal anthropology does the same with the very limited and specialized aim of discovering the nature and origin of the phenomenon of crime. Every phenomenon, however, remains inexplicable if it be examined alone; the explanation is easier if it be studied in the complex of phenomena developed in the double physical and social *milieu* of which we have spoken."

Words such as these, where we find embryology, physiology, anatomy, chemistry, and statistics, invoked as aids to the origin of crime, place us at the antipodes of ancient philosophies; yet Lombroso and his school are in reality acting on the old-world notion embodied by Horace in his "*mens sana in corpore sano*." The delinquent, they argue, acts abnormally. Acts being the visible results of functions performed by the brain and reflective nervous system, it follows that these functions are abnormal. The functions being abnormal, the organs which perform them must be either abnormal or troubled in their action by the habitual or accidental interference of disturbing causes, for no normal organ acting under normal conditions can perform abnormal functions. The founders of this new school, therefore, dedicate themselves first of all to the study of the skull, brain, and nervous system of the criminals; then

make careful observations not only on other parts of the skeleton but on the living body; the height, length, and proportion of the members, the total or partial development of each part; the weight of the body, its muscular development, the deeper-seated organs, such as the heart, liver, kidneys, intestines; the various functions which may directly or indirectly affect those of the brain, such as the circulation of the blood, digestion, and the disturbances which show themselves there, and in consequence of the general state of the organism as regards the balance of the vital functions; sleep, sexual manifestations, normal or abnormal muscular force, and other factors besides. Everything, indeed, which concerns the morphology of the criminal is passed through the sieve of the severest scrutiny. This scrutiny reveals, as might be expected, various irregularities. The skull, for instance, presents anomalies of shape and size, being in a large percentage of cases abnormally small; anomalies indicative of regression and of arrested development; anomalies in the position, shape, and closing of the sutures, "the doorways of the head" being invariably closed too early. Morphological irregularities are also found in the bones of the face, notably in those of the nose and lower jaw. The brain itself, say the investigators, shows unmistakable signs of a degraded form, in the number and distribution of the cerebral convolutions, in the entire atrophy of some parts, in the extraordinary development of others. The shape and structure of the skull and brain, says Lombroso, connect criminals very closely with primitive man, and even with his animal ancestors. Criminals must be regarded either as forms belated in the race of development, or as physical and therefore also moral degradations—unavoidable, regrettable products of our civilization. In either case they form a distinct species, in need of scientific investigation.

The action of the brain is, however, not only modified by its form and development, but also, in a very large number of cases, by pathological occurrences. Traces of old wounds, "some head-blow not heeded in his youth," said Sir Kay of King Arthur's self—hæmorrhages, affections of the investing membrane and of the blood-vessels are seldom wanting. In other words, the organ that controls and originates actions is in a morbid state. Further, the slight irregularities constantly verified in the branchings of the blood-vessels in the heart, liver, and other viscera can not but conspire, by the abnormal functionings they occasion, toward the production of physiologically irregular organisms.

Intimately connected with the physical conditions of the criminal are his psychic peculiarities. These consist chiefly in great instability of character, coupled with overwhelming development of some passion and the atrophy of some others. The criminal acts from

impulse, although he often displays, as madmen do, a low cunning in finding means to carry out his impulse. He is intensely vain, priding himself on the number of crimes he has committed. He is further devoid of all remorse, fond of boasting of his evil deeds and of describing them in detail. Thus Lombroso gives the reproduction of a photograph, in which three murderers who had assassinated one of their number caused themselves to be represented in the very act of committing their deadly deed, a photograph taken for the benefit of their less fortunate associates.

This inordinate vanity is often in itself the primary cause of terrible crimes, especially in young men who have just attained puberty, an age observed to be especially fruitful in crimes of violence. The critical character of this period, even in well-balanced minds, is abundantly known; little wonder, then, if it prove fatal to those whose constitutions urge them to extremes. It is noticed also that the criminal needs to lead a life full of noise. The necessity of orgies entailed by the irregularities of his feelings is often the moving cause of some act of violence, such as robbery and assassination, calculated to procure the means of indulgence. His affections, too, are abnormal: he will assassinate father and mother, and yet be capable of making sacrifices for some companion in time of illness. This trait, however, occurs more often among women than men. We used to believe there was a species of honor among thieves, but Lombroso asserts that it is rare to find any consistent attempt to shield each other; on the contrary, the almost physical need they feel of talking incessantly renders them specially inclined to mutual betrayal. The criminal is fond of tattooing himself, and so distinctive a mark of criminal tendencies is this held in Italy that tattooed recruits are looked on as likely to make bad soldiers; and a private once spoke to Lombroso of tattooing as "convict habits." He presents, too, an extraordinary insensibility to pain, tattooing himself in places which even the Indians spare, and receiving or inflicting on himself the most terrible wounds without a murmur.

He has a language of his own, employed even in cases where he would run no risk from using ordinary speech, and this still further isolates him from the rest of mankind. He has a writing of his own, too, made up of hieroglyphics and rough pictures.

Such briefly is the *Frankenstein*, which the modern science of criminal anthropology evokes; an unbalanced being, a pathological subject, whose illness takes a form which, hurtful to society, is defined as crime. For the facts collected by Lombroso place beyond all doubt the intimate connection between crime and mental derangements which has so long been suspected to exist. Madmen and criminals belong to the same family; not in the sense of the vulgar

and unthinking expression that all criminals are mad, though everyday experience in the police courts puts it beyond doubt that many are actually deranged, but in the sense that both classes are in a similar pathological state, which manifests itself on the one hand in lunacy, on the other in crime. This position is rendered still stronger by the revelations of genealogical statistics, which reveal the heredity through long generations of criminal tendencies, as they do of insanity, and alternations of criminals and madmen, in the same or successive generations.

Lombroso divides criminals into two great classes, the original or born delinquent, and the fortuitous offender, a man who becomes criminal through outward influences.

The first, the synthesis of every degeneration, the outcome of all biological deterioration, commits crimes against society by virtue of a morbid process passing from one generation to another, derived from cerebral and other physiological conditions. In him the impulse of passion is not sullen or isolated, but associates itself almost always with reflection. The second, on the contrary, the criminal of passion and impetus, acts at a given moment in consequence of an overwhelming stimulus, say a sudden access of jealousy. The two classes frequently merge into each other, for the mere fact that a man, suddenly, without reflection, by a reflex act, as it were, stabs his offender or his unfaithful wife, proves that he is not normal. The want of reflection constitutes an extenuating circumstance before judge or jury, but before pathological psychology, says Signor Sergi, "it constitutes an accusation."

The importance of the distinction is seen in the views taken on criminal jurisprudence by Lombroso and his school. It is generally said that to act logically in face of these views we should have to make extensive use of capital punishment. The most hasty perusal of Lombroso's books will show that this is not his view of the case. He lays immense stress on prevention, for even the morbid process may, he asserts, be modified in the very young, just as a disease, taken in time, may be cured, but, neglected, becomes chronic.

He examines carefully the means adopted in various countries for refining the minds of children, and speaks warmly of English ragged schools. Juvenile refinement, strict but judicious control, education in the highest sense of the word—these must be, he argues, the primary object of every nation which aims at decreasing its criminality. He also advocates an association between various nations for the hunting of criminals, and for making such observations on their lives and habits as shall lead to their easier classification. In reformatories he has small belief; statistics show that they in no way decrease the percentage of recidivists; the fact of recidivism shows

the habitual criminal, and here no punishment will suffice. The man must be treated as though afflicted with a serious illness and removed from society, for which, however, he may and should be made to work. He insists that these questions are of vital importance to



ENRICO FERRI.

every nation, and asserts repeatedly that teachers in ragged schools and founders of polytechnics are patriots and philanthropists in the highest sense of the words, because helping to stamp out crime more than all the long-term sentences in the world. Crime is at once a biological and a social phenomenon. The criminal is a microbe which only flourishes on suitable soil. Without doubt it is the environment which makes the criminal, but, like the cultivation medium, without the microbe it is powerless to germinate the crime. To use Professor Ferri's expression, up to recent times the criminal has

been regarded as a sort of algebraic formula; the punishment has been proportioned not to the criminal but to the crime. Anthropologists are teaching us to strive after scientific justice. Time and events have brought into clear relief the inadequacy of legal maxims, founded on antiquated and unscientific conceptions, and thus modern Italians show us that not the nature of the crime but the dangerousness of the offender constitutes the only reasonable legal criterion to guide the inevitable social reaction against the criminal. This position is the legitimate outcome of the scientific study of the criminal. And where the man of science has led the way the man of law must follow.

Such, in brief and somewhat in the rough, are the conclusions of Italian criminal anthropology, which we have given at some length, as the subject is too vast as well as too new to be clearly comprehensible in a few words. In the autumn of 1896 an International Congress of Criminal Anthropologists was held at Geneva, and on this occasion the Italian school triumphed as never before over all adversaries and schismatics, and especially over their French col-

leagues, who have carried their antagonism to Italy and things Italian even to the serene fields of science. The French objections were beaten down by a very hailstorm of facts, so carefully collated, so industriously collected, that opposition was perforce silenced. In the front ranks of the combatants, indeed, leading the attack, was that eminent criminal sociologist, Enrico Ferri, whose legal vocations have not hindered him from continuing his favorite studies, though he is no less valiant as a lawyer than as a scientist. Indeed, he holds that the two studies ought to go hand in hand. All lawyers, he affirms, should dedicate themselves to the study of criminal anthropology if they would go to the fountain-head of human responsibility; all judges should be inspired by this doctrine, ere blindly punishing a culprit on the faith of a code not always founded on direct observation of the environment or of the individual. "It is not true that with Lombroso's theories all prison doors would be broken down and respectable humanity given over to the mercy of delinquents, as our opponents say. And were the first part of this strange paradox to be verified—i. e., that which demands that in order to be logical all prison doors be opened—there would open also those of the lunatic asylums in order to permit the entry of the men ejected from the prisons, individuals whose mental and physical constitutions pushed them into crime." It was just this theory of the *born* criminal, which Lombroso was the first irrefutably to prove, and whose effects must shortly be felt in criminal legislation, that carried off the most clamorous victory at Geneva.

Cesare Lombroso, who is a Hebrew by birth, was born at Turin, in 1836. As a mere lad he loved to write, and composed, with the same facility and rapidity that distinguishes him to this day, novels, poems, tragedies, treatises on archæological, physiological, and already on sociological subjects, those dating from his student days being actually published, so much talent did they show. Medicine



CESARE LOMBROSO.

was the study to which he devoted himself, and his first independent researches were directed to examining into the causes that produce the idiotism and the pellagra that exist, unfortunately, so largely in Lombardy and Liguria. His treatise on this theme attracted the attention of no less a person than Professor Virchow. After fighting for the independence of Italy in 1859, he was appointed professor of psychiatry at Pavia, where he founded a psychiatric museum. From Pavia he passed to Pesaro, as director of the Government mad-house, and thence to Turin as professor of forensic medicine, a position he still retains. It was in his native Turin that he began those original studies destined to make his name famous over all the globe. Endowed by nature with a strong intelligence, a robust will, and a keen intellectual curiosity, he was indifferent to the incredulous smile, the sarcasms, that greeted his first efforts at solving problems hitherto held insoluble. Very bitter, very hard were his struggles—how hard only those can appreciate who have talked with Lombroso in intimacy and have noted the pained scorn with which he speaks of his adversaries—adversaries some of whom are not silenced to this hour. But his science, his studies conquered, which if not always complete yet are always serious, wherefore criminal anthropology, a mere infant some thirty years ago, may to-day be said to be adult; a raw empiric but a while ago, to-day a science, young if you will, but vital and destined to overturn the facile, fantastic monuments erected by so many penalists. The work with which Lombroso will go down to posterity is a huge book, huge in every sense of the word, in which criminal man is studied on a scientific basis. We refer to the *Uomo Delinquente*, of which its author has published most recently a new, revised, and enlarged edition, wrestling with new facts, new observations, and new deductions. This edition is limited to one hundred copies, perhaps to allow its prolific author soon to issue another, enriched with yet more facts, yet more acute deductions.

It is dedicated to Max Nordau, the author of that noted book, *Degeneration*, who had in his turn dedicated his work to his master, Cesare Lombroso. The dedication reads thus: "To you I have wished to dedicate this volume with which I close my studies on human degeneration, as to the most sincere friend I have found in the sad course of my scientific life, and as to the one who has wrested fecund fruits from the new doctrines I have attempted to introduce into the scientific world." Needless to say that Lombroso is the very first person to admit that in the almost virgin field of criminal anthropology there is still much to do, and that Science has not yet spoken her last word; but it is his magic wand that has indicated the horizon and has swept over vast new areas, often with

lightning rapidity and intuition. Thus the base of the new edifice was laid, and the rest of the new monument rose up rapidly around it, notwithstanding its occasional faultiness, pointed out eagerly by adverse scientists, criticisms that could not shake down the edifice, for its base was too solid and strong. Gradually a few apostles of the new science gathered around Lombroso, and although Morselli, one of the most acute and cultured observers, after a time severed himself from the group and joined the French schismatics, nevertheless the little compact mass moved from success to success, from triumph to triumph, up to the late ultimate triumph at Geneva.

Another of Lombroso's books which aroused much discussion and which may almost be said to have founded yet another school, if we may so designate the group devoted to the study of another branch of anthropology, was *Genio o Follia*, which largely helped to make its author's name known even outside of strictly scientific circles. This work enchanted all thinkers, psychiatrists, doctors, indeed, all men who dedicate themselves to the search for signs of madness in the lives and works of eminent authors and artists. For Lombroso had striven in this book to prove scientifically how closely genius and madness are allied. As was the case with *Criminal Man*, so here too the master's disciples strayed from the paths laid down by the pioneer, exaggerated his conclusions and carried them to absurd excesses. Lombroso had at last to raise his voice against the extravagances into which he was dragged. Besides various absurdities, there were published some careful serious studies having for their themes the lives of Napoleon I, Leopardi, Ugo Foscolo, and Byron, in which it was made to appear that these men were all victims of heredity, and neither their virtues nor their vices were their own—studies of interest, academically considered, but of no tangible utility, and which did not add or detract one iota from the merits or demerits of their subjects. Against this method of dealing with men of genius as pathological subjects Mantegazza recently very rightly upraised his voice in the name of art, tradition, and history.

Space does not permit of our naming Lombroso's varied and voluminous writings, whose enumeration any biographical dictionary can supply. *La Donna Delinquente* (The Criminal Woman), written in collaboration with G. Ferrero, one of the most promising of the younger criminal anthropologists, of which an incomplete and inadequate translation appeared in England, aroused a storm of discussion on its publication four years ago, and was especially attacked by the adherents of the old methods. He has since published *The Anarchists*, in which he also takes unusual views with regard to these latter-day society pests—pests for whom society itself, as nowadays conditioned, he holds as alone responsible—and *Crime*

as a Society Function, which has aroused the fury of the clerical and moderate factions in Italy. Chips from the workshop of his extraordinarily prolific brain, ever evolving new ideas, new points of view, he scatters in the many articles he loves to write for English and American periodicals; but his most important scientific communications he reserves for the *Archivio di Psichiatria*, which he edits together with Ferri and Garofolo. His work is by no means perfect: he is apt to jump too rapidly at conclusions, to accept data too lightly; thus he was led at the beginning to overestimate the atavistic element in the criminal, and at a later date he has pressed too strongly the epileptic affinities of crime. Still, when all is said and done, his work is undoubtedly epoch-making, and has opened up valuable new lines of investigation and suggested others.

We said that Lombroso's first studies were directed to the pellagra, that strange and terrible disease which annually mows down such a vast number of victims in the fair land of northern Italy, and

which is a luminous proof of the grave financial condition of the laborers in some of the most beautiful and richest regions of the world. Concerning this terrible illness, which densely populates Italian madhouses, all students of natural science have long been gravely occupied. For the terrible increase in lunacy noted by Italian statistics in the last five years the pellagra is largely responsible. Psychiatry, which has abandoned the old methods in Italy, is no longer a jailer employing the methods of an inquisitor, but a science that seeks for ultimate causes and remedies, and, conjoined to eco-



ENRICO MORSELLI.

nomic and political science, endeavors to restore to society a large contingent of forces which would otherwise be destroyed by disease. Especially active in this department is Enrico Morselli, at present director of the hospital attached to the Genoa University. Morselli is in the flower of his life, and much may be still hoped from him. Like Lombroso, he is small of stature and

square built; like Lombroso, he has piercing eyes that shine forth acutely from behind glasses that he always wears. Psychologist, anthropologist, psychiatrist, philosopher, and literary man, Morselli has right to all these titles, and in each branch he is noteworthy. He was born in Modena in 1832, and studied at his native university, carrying off high honors. As a mere student he attracted attention by disputing the conclusions of a noted celebrity on some anthropological points, proving himself right. For a while he was the assistant of Mantegazza in arranging his Anthropological Museum, one of the finest as well as one of the most important in Europe. When only twenty-eight he was called to preside over the Turin lunatic asylum, and soon distinguished himself by his profound knowledge of everything connected with the study and treatment of the demented. Besides attending to his profession he found time to write a number of works dealing with normal and abnormal mental maladies, whose mere enumeration would fill pages, some of which, like his work on Suicide, have been translated into English. Morselli's latest work was a reply to Brunetière's assertions regarding "the bankruptcy of science," demonstrating that here was a case in which the wish was father to the thought, and for which no real foundation existed.

Paolo Mantegazza has been dealt with at length in these pages, and we need not go over the ground again. What is needful to say is, however, that he has been left behind in the rapid onward tramp of his younger colleagues. Mantegazza is perhaps entitled to lay claim to the name he loves to sport, that of the father of Italian anthropology; but, according to the more precise views of our day, he can hardly be regarded as a real scientist. As is often the case, the sons have outstripped the father, who now combats the views of his legitimate offspring. A reproach cast at Mantegazza, it would seem not without reason, is that he too closely follows Molière's precept, "*Je prends mon bien où je le trouve*," and that he has passed off as his own the conclusions and the work of German scientific men. Another reproach that is certainly well founded is his manifest delight in handling obscene themes, and handling them not in the calm, scientific spirit that removes from them a real obscene character, but treating the details with a gusto that reveals how these prurient matters rather delight than disgust him, and what is worse, these works are written in popular language, frankly appealing to a popular rather than a scientific audience. To this class belong all his works on Love, on Women, on the Art of taking a Wife, of Being a Husband, etc. It may safely be asserted that his fame is steadily declining, and that his want of perseverance and observation is itself to blame for this. By nature Mantegazza was endowed with a fine

and versatile intelligence, but he has lowered it in the search after cash and easy success. This handsome old man, with the face and smile of a satyr, is a familiar figure on the streets of Florence.

The number of men who are strict anthropologists without being sociologists is extraordinarily great in contemporary Italy, and there is none of them who has not done good and original work. Limits of space oblige us perforce to pass them by, in order to speak of yet others of the new school created by Lombroso's theories, and who take rank in the files of criminal anthropology, a science far more interesting to the general reader than that which deals with biology pure and simple. To this section in the first rank belong the alienists, besides a large number of lawyers, judges, and journalists. The highest position among them belongs indubitably to Enrico Ferri. His verdict, like that of Cesare Lombroso, is constantly appealed to in complicated criminal cases where the sanity or the natural proclivity to crime of the person is in question. A man of really unusual physical beauty is Enrico Ferri, as well as of charm of manner and of eloquence which, when stirred to a theme dear to his heart, carries all before it. Enrico Ferri was born in 1856, in the neighborhood of Mantua, a city whose very name in Austrian days was synonymous with cruel despotism, for this and Spielberg were the favorite fortresses of the German persecutors. At a tender age he lost his father, and his mother, left in straitened circumstances, had a hard struggle to give her only child an adequate education. Already at the university Ferri distinguished himself, publishing a thesis which dealt with criminal law. When Lombroso published his great work on Criminal Man, Ferri was at once attracted by its scientific nature and sought to become acquainted with its author. Since then they have been fast friends as well as co-workers. In 1881 he was called to fill the chair of penal law at the University of Bologna. His opening discourse dealt with the theme which was to prove the first draft of his great work, Criminal Sociology, a work which has been translated into many European tongues. The lecture was entitled *New Horizons in Penal Law*. He says: "It was in this inaugural discourse that I affirmed the existence of the positivist school of criminal law, and assigned to it these two fundamental rules: 1. While the classical schools of criminal law have always studied the crime and neglected the criminal, the object of the positivist school was, in the first place, to study the criminal, so that, instead of the crime being regarded merely as a juridical fact, it must be studied with the aid of biology, of psychology, and of criminal statistics as a natural and social fact, transforming the old criminal law into a criminal sociology. 2. While the classical schools, since Beccaria and

Howard, have fulfilled the historic mission of decreasing the punishments, as the reaction from the severity of the mediæval laws, the object of the positivist school is to decrease the offenses by investigating their natural and social causes in order to apply social remedies more efficacious and more humane than the penal counteraction, always slow in its effects, especially in its cellular system, which I have called one of the aberrations of the nineteenth century."

Ferri has occupied himself less with the instinctive than with the occasional criminal, and his clear and philosophic spirit has placed him at the head of criminal sociologists. Elected to Parliament even before the age of thirty, previous to which he could not take his place, according to Italian law, he began an avowed liberal, but soon passed over to the ranks of scientific socialists, whose acknowledged leader he has since become. He also holds the post of professor of penal law at the Roman University. But his home is on the vine- and olive-clad shores of Etruscan Fiesole, within a short walk of Florence. Of his great work on Homicide we have treated at length in these pages. Though in some points he has grown to differ from him, Ferri continues to venerate his master Lombroso, and with rare eloquence defends his theories from attacks at moments when the less eloquent scientist seems silenced by the arguments of his adversaries. It was due to his energy, conjoined to the initiative of Lombroso, that the first International Congress of Criminal Anthropologists was held in Rome in 1885, which constituted the installation of international criminal anthropology in sight of the European public. The second was held at Paris in 1889. It was there that the scientific misunderstanding arose, which was still more openly affirmed at the third congress held at Brussels in 1892, but was finally and conclusively beaten down at Geneva at the fourth congress in 1896; a result in a large measure due to Ferri's fascinating, all-persuading eloquence. In a letter written to me he has stated the whole matter so clearly that I can not do better than reproduce the same: "As you know, the positive school of criminal studies was consolidated in Italy by the contemporaneous publication in 1878 of the second volume of the *Uomo Delinquente*, of my volume on the Imputableness and Negation of Free Will, and of the pamphlet of Garofolo on the Positive Criterion of Penalty. In these first affirmations there naturally preponderated the conclusions of Lombroso, which gave and left on the public the impression that the new school only studied the criminal from his organic side as a biological monstrosity. Yet, in 1880, I had published my studies on Criminals in France from 1826 to 1878, in which I expounded the natural factors of the three orders

of crime—anthropological, physical, and social—laying stress on the social causes that conduce to crime. As a reaction from the aforementioned impression in Italy, Turati, Colajanni, and Battaglia published in 1882 to 1884 pamphlets and volumes maintaining that crime is an exclusively social phenomenon. I replied to Turati—Crime and the Social Question—with the volumes on Socialism and Criminality (1883), now out of print, where I combated: 1. Artistic and romantic socialism while recognizing the fundamental truths of scientific socialism. 2. The unilateral theory that crime is the product *only* of social factors, and that, therefore, with time it must certainly disappear. Continuing to maintain these two propositions, even after my avowed adhesion to scientific socialism, it has come about that in Italy this unilateral thesis has gradually become abandoned even by socialists. On the other hand, this thesis was taken up again in 1885 at the congress in Rome, and above all in 1889 at Paris, and in 1892 at Brussels by the French anthropological criminal socialists—Lacassagne, Tarde, Topinard, Corée, etc.—who succeeded in spreading the belief that there exists a French criminal anthropological school founded on the theory that the criminal is an exclusively social phenomenon—a thesis that had, for the matter of that, already been sustained in Italy by the socialists. It is thus that was circulated among the international public, who can not read Italian publications unless they are translated, the impression that opposing the Italian school there was a French school; the former maintaining the exclusively biological origin of the criminal, while the latter regarded his genesis as exclusively social. The congress at Geneva has cleared up this misunderstanding, which has lasted too long. Crime is a phenomenon whose origin is both biological and social. This is the final conclusion which the Italian school has proclaimed since the beginning of its existence.”

It is noteworthy and also significant that almost all thoughtful Italians who have dedicated themselves to the studies of anthropology in general and criminal anthropology in particular are socialists in politics. Assiduous, dispassionate observation of mankind would seem to have brought them to this conclusion. A leader in the Italian Parliament in this sense, as well as a gifted criminal anthropologist, is Napoleone Colajanni, by original profession a doctor, but now too absorbed in his political duties to practice. Colajanni is by birth a Sicilian, and has much of the quick, fiery temperament of these islanders, in whose veins the blood courses hotly. A facile orator, his speeches always command attention in Parliament, while his rigid, incorruptible honesty makes him esteemed in a *milieu* of unscrupulous politicians and wire-pullers. As philanthropist, as politician, he was

early attracted to study the problems of misery and crime, whence resulted his great work on Criminal Sociology. Like Ferri and all the other thoughtful students of the criminal, he has seen the direct bearing on criminality of what he himself well calls "social hygiene." He points out how we may neglect the problems of social organization, but must do so at our peril. In many respects he is opposed to Lombroso. He holds, for example, that Lombroso has too much accentuated the atavistic element in the criminal. He agrees with those who deem that of a great number of modern habitual criminals it may be said that they have the misfortune to live in an age when their merits are not appreciated. Had they lived in the world a sufficient number of generations ago, the strongest of them might have been chiefs of a tribe. As Colajanni has said: "How many of Homer's heroes would to-day be in convict prisons or at all events despised as unjust and violent!" He has strenuously combated Lombroso's indiscriminate method of collecting facts, and compares it to Charles IX's famous order on St. Bartholomew's Eve: "Kill them all! God will know his own."

And now it is time we should speak of Garofolo, the Neapolitan lawyer who, accepting generally the conclusions reached by Lombroso and Ferri, has become the most distinguished jurist of the moment, the pioneer of the reform of law through the method of natural science. His Criminology is marked by luminous suggestions of wise reform. Like Morselli, Garofolo does not blindly follow where his compeers lead. His latest volume, entitled *Socialistic Superstitions*, has excited much wrath and astonishment in socialistic and anthropological camps, and was severely combated, especially by Ferri, who wrote a pamphlet on purpose to confute the publication. R. Garofolo was born in Naples, in 1852, of an old patrician family, hence perhaps by atavism he is debarred from being a socialist. He holds the position of professor of law and penal procedure in his native city, and was intrusted by the Government in 1892 to draw up a scheme for the revision of the penal code. Garofolo has occupied himself chiefly,



R. GAROFOLO.

may, entirely with the legal side of criminal anthropology, and his great work *Criminology* deals with the means of repressing crime quite as much as with its nature and causes. He has also studied the question of what reparation is due to victims of crime. His only flight into sociology has concerned his attack on socialism, in whose curative Utopia he does not believe.

Among the latest contributors to this fascinating science the highest places belong to three young men: Scipio Sighele, Guglielmo Ferrero, and A. G. Bianchi. All three are journalists, all three distinguished by the same qualities of keen observation, of more than ordinary cultivation, with sometimes a tendency to write a little hastily and to jump to conclusions too rapidly. This reproach especially concerns Sighele, who has allowed himself to judge and write of matters English and American of which he has but the most superficial and second-hand knowledge. Here the newspaper writer has done wrong to the scientist. Sighele made his name with an admirable book entitled *The Criminal Crowd*, which a French writer has thought fit to appropriate in outline and almost entirely in

substance, obtaining for it the honor of translation into English, while the real author has been left out in the cold. Able, too, is *The Criminal Couple*. A paradoxical pamphlet directed against parliamentary government, and revealing the failure of a system on which the hopes of Europe were once based as the sheet-anchor of liberty, excited some attention on its appearance in 1895, and was dealt with at length in *Blackwood's Magazine*. His last work, on *Individual Morality* as opposed to *Public Morality*, inspired by the doubtful morality of Signor Crispi's government, also aroused dis-



SCIPIO SIGHELE.

cussion, especially among Crispi's adherents, who looked on the book as a bit of special pleading in favor of their master's dubious political proceedings.

Guglielmo Ferrero is a Piedmontese, and belongs to an old

aristocratic family of Turin. Although his name is already well known in scientific circles, he is still little more than a youth. Together with Lombroso he wrote the *Criminal Woman*, spoken of at length in these pages, and which at once brought him to the front, as all the world knew that it was he who collated and collected the facts therein contained. His first independent work was that most remarkable one dealing with Symbols, of which we have also spoken before. His latest publication deals with Crispi, whose personality he subjected to a scientific analysis qualifying him as a born madman. Ferrero, too, is a convinced socialist, and on this account was arrested during the reign of terror that prevailed in the course of the last months of Crispi's dictatorship. He was ordered to leave Italy, and, profiting by this enforced exile, he visited Germany and learned the language and the condition of anthropological studies in that land. He has but recently returned. His magazine articles are always able, and marked by a high and independent tone.



GUGLIELMO FERRERO.

A. G. Bianchi, a Milanese by birth, is also young. Not rich, like Ferrero, he had to make his own way, and entered into journalism as a means to obtain daily bread. He began life as a railway official, writing at the same time reviews of new books, Italian and foreign. Together with a colleague he founded a paper called *La Cronica Rossa*, and it was in these pages that he began to occupy himself with scientific literature, and to prove himself an enthusiastic follower of Lombroso. He entered the best Italian newspaper, *Corriere della Sera*, as its legal editor, and thus became even more enamored of criminal anthropology. Intelligent, industrious, studious, he dedicated himself to the new science with ardor, and in a short time became allied to Lombroso and Morselli, who both applauded his zeal and his methods of working. Together with Sighele he issued a publication on Criminal Anthropology, richly illustrated with pictures, diagrams, and statistics, which met with favor even outside of strictly scientific circles. A remarkable book published by him is the *Romance of a Born Criminal*, the

autobiography of a convict, founded on authentic papers committed to his hands by the eminent psychiatrist Silvio Venturi, director of the lunatic asylum at Catanzaro, a book which was translated immediately on its appearance into German, but which no English publisher has had the courage to issue, though it states at once in its preface that its scope is purely scientific, and that the word "Romance" is employed in a subjective sense. This piece of pathological literature throws a lurid light upon the inner nature of the criminal. Bianchi has written a long and careful preface, in which he points out just how and why this human document has scientific value. As yet, Bianchi has not had time to write many books, but his careful, studious articles are all of value, and denote his knowledge, intuition, and observation.

Limits of space, which we have already exceeded, oblige us to leave unmentioned yet other valiant followers of criminal anthropology in Italy, but we hope we have said enough to prove that this science has in the peninsula both numerous and able adherents, and that Italy is justified in considering herself at the head and front of studies of this nature—a position which, indeed, few dispute to her. Seeing how useful is this science as an auxiliary to the right study of history, literature, and political economy, it would be well if its propagation were more encouraged at universities, in place of philosophy and metaphysics, which, when untouched by this new breath, have become fossilized and are as arid as they are sterile.



THE QUESTION OF WHEAT.

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I.

A YEAR of abnormal conditions in trade and industry brings out a plentiful crop of predictions of great approaching changes. If the prophets of economic revolution, who base their prophecies upon half-digested statistics, were to be gathered, and their confident prognostications exhibited in the light of ascertained results, or even of rationally tested tendencies, the asylum of Laputa, as described by Swift, would be of secondary interest. We have been treated in recent years to many a sensational diagnosis of social trouble, fraught with dangers to the body politic. No one will deny that such dangers exist and are even threatening to break upon us or to carry on their operation until only an explosion can clear the atmosphere and permit a renovation on new lines of activity.

It is because there are a number of true diseases of society to be met that the studied attempts to create new problems, neither imminent nor at present active, must be deprecated. When these attempts are based upon half knowledge of facts, to use no stronger term, they are still more to be discouraged as hostile to the welfare of the community, and as giving rise to policies that can only end in mischief or disaster. Much of the social unrest which finds expression in political activity has been bred and fostered by the agitation of half truths or of falsehood clothed in a quasi-scientific garb.

At present the question of the wheat supply of the world is prominent, and is being discussed in a manner that produces alarm, and with the alarm encourages every social quackery for its alleviation. Because the year 1897 was a phenomenal year in wheat—every one will admit that to be a fact—the fears of future famines and a general want throughout all wheat-consuming countries of the world are harped upon and magnified until the evidence seems to amount to a demonstration, and nothing remains for the civilized world but to become reconciled to a lowering of the standard of comfort, the substitution of a cereal of secondary quality for one that ranks next to meat in high food efficiency. The corners of the world are ransacked for figures to bear out so dire a prediction. Decreasing acreage devoted to wheat, reduced yield of crops, falling per-capita consumption of wheat, and market prices that seem to bear out the fact of an approaching if not existing famine, every incident of depression is carefully collated, and a picture drawn which casts into shade the fearfulest famine experienced in the world's history.

The error underlying such a presentation is a very common one, for it involves a partial study of a problem where the factors are so many as to present a double difficulty. Not only must the facts and statistics be collected, but they must be arranged in such a form as to be both intelligent and intelligible. Every statistician does not deserve implicit confidence. The most difficult task of the user of statistics is to attain to a proper appreciation of the relative value of compilers of statistics. Even Government work, though covered by the shield "official," is not above criticism, and if a bureau with the weight and authority of Government behind it is liable to go wrong, how much more liable to this mischance is an individual, whose interest may mislead, or whose eagerness to establish a thesis may blind to certain important phases of the problem. In the statistical treatment of any question the greatest care is needed to test fully the combination of figures presented, for a flaw in arrangement may lead to ridiculous conclusions.

These precautions of appreciating men and their work are all the more necessary in matters where the statistics at hand are im-

perfect or incomplete. This is the case with all agricultural statistics, and especially so with the returns of crops, always an estimate of uncertain foundation. No two fields of grain are exactly the same, and the variation of field to field is exaggerated when it is made the basis for an estimate of the condition or yield of crops in a township, a community, or a State. The observers are different, and each observer would look at the same field through the medium of a personal equation. No general rules can be laid down for preparing these estimates, and much latitude must be given to the agent. In our own crop service, as conducted by the Department of Agriculture, the estimates of crop condition are based upon reports from 56,700 regular correspondents, reporting monthly, and 140,500 special correspondents, reporting at particular seasons of the year. Even the Secretary of Agriculture is not satisfied with this machinery. "I am much impressed," he writes in his report for 1897, "with the extreme cumbrousness of the system of crop reporting that has been in use in this division" (of statistics) "during the last few years. Instead of conducing to completeness and accuracy, it would appear from the report of the statistician to in some measure defeat its own object by its unwieldiness, and by the fact that the indefinite multiplication of crop reporters weakens the sense of individual responsibility." The defects of the system have been recognized by others, who are obliged to be informed on the crop conditions, and who have been compelled to look elsewhere than to the Department of Agriculture for crop returns and estimates. The "commercial estimates" prepared by experts, and checked by actual receipts or movement of grain, find a more ready acceptance than do the "official" estimates. In the last season the commercial estimate placed the crop of wheat at 550,000,000 bushels, while the department forecast a yield of only 450,000,000 bushels, a difference too large to be admissible in a statistical examination of the same subject. The reporters for the department, practical farmers as most of them were, did not wish to report a heavy crop, lest the market be influenced and prices fall. A short crop appeals more to their interest, and their estimate inclines, consciously or unconsciously, to an understatement of conditions. "The best authorities are now agreed that in 1891 the bureau (of agriculture) underestimated the American wheat crop by 73,000,000 bushels, in 1892 by 64,000,000 bushels, and in 1893 by 79,000,000 bushels." * "In 1894 the Government estimate in December of the wheat crop was 460,000,000 bushels, while the best commercial estimates of that year were 525,000,000 bushels." †

* New York Evening Post, August 11, 1897.

† Ibid., August 16, 1897.

It must be admitted that there are unusual difficulties in estimating such a crop as that of wheat. It is not purely a commercial crop, where the whole product comes into the market to be recorded commercially, as is the case with cotton. A part is consumed on the farm, another part is retained for seed, and the proportion of crop brought to market varies with the price offered and the necessities of the farmer. There are many opportunities of error in arriving at the resultant of these patent conditions, without undertaking to measure other influences that tend to check or promote deliveries and free movement of wheat from the producer to the market, not to speak of the international competition that overshadows the whole subject. It is not a little absurd to dogmatize in the face of so many uncertainties, and all the more absurd when a limited space of time is taken for study. In commerce, the shortest period on which to determine the trend of movement should not be less than twenty years, and as many more years as the returns will permit strengthen the argument. In agriculture the same rule holds. There is an undoubted periodicity in the ebb and flow of industry and agriculture, of commercial and financial movement—waves of prosperity and depression. It would be as misleading to accept a year of depression for a standard as to apply a year of prosperity. In the wish to throw some statistical light upon the position of wheat, I have prepared some notes upon the conditions surrounding the production of this important cereal in different parts of the world, and the conditions controlling its commercial movement in some of the leading markets. As the trade returns of import are more accurate than those of export, I begin with a consideration of the great free wheat market of Great Britain.

In 1849 the duty upon imported wheat was fixed at the nominal rate of one shilling per quarter. In ten years the trade had adapted itself to this rate, and no disturbing influence was exerted by any threatened change of rate, so that 1860 may be taken as a fair starting point for this examination. In that year the United Kingdom imported 25,484,151 quarters (one quarter equals eight bushels) of foreign wheat. Of this quantity the larger part—sixty-seven per cent—was obtained from European countries, of which the more important were Germany and Russia. Outside of Europe the leading sources of supply were the United States, Egypt, and British North America. The general relation of those countries is shown as follows:

Russia.....	5,638,299 quarters.
Germany.....	6,542,601 “
United States.....	6,497,335 “
Egypt.....	854,815 “
British North America.....	794,829 “

The civil war in the United States and the financial measures taken by our Government had a temporary influence, first, to stimulate exports, and secondly, to discourage them after the primary effect of an irredeemable paper currency had passed. The reaction was such as almost to destroy the ability of the United States to export wheat, and it was not till some years after the return of peace that its wheat recovered its true position in the English market. This course of the wheat trade was the most notable incident in the history of that trade since 1860, and a few figures are given to show its remarkable rise and fall. The comparison is of further interest as developing apparent sympathetic fluctuations in the imports from British North America and Egypt. The Canadian flow may be accounted for by the conditions then prevailing in the United States, but the Egyptian stands alone in its curious reflection of the rise and fall in American export.

YEAR.	Exports from the United States.*	Imports into the United Kingdom from			Gazette price of wheat per quarter.	
		United States.†	British North America.	Egypt.		
	Bushels.	Cwt.	Cwt.	Cwt.	s.	d.
1860.....	4,155,153	6,497,335	794,829	854,815	58	3
1861.....	31,238,057	10,866,891	2,381,275	1,472,514	54	4
1862.....	37,289,572	16,140,670	3,732,959	3,289,156	55	5
1863.....	36,160,414	8,704,401	2,093,997	2,319,590	44	9
1864.....	23,681,712	7,895,015	1,225,523	866,868	40	2
1865.....	9,937,876	1,177,618	306,765	10,063	41	10
1866.....	5,579,103	635,239	8,789	33,831	49	11
1867.....	6,146,411	4,188,013	683,127	1,451,774	64	5
1868.....	13,940,899	5,908,149	557,443	3,219,536	63	9
1869.....	17,557,836	13,181,507	2,723,053	1,004,479	48	2
1870.....	36,584,115	12,371,922	2,838,361	104,950	46	10

In the period the need of England for foreign wheat increased, and yet one of the best countries of supply was, to all purposes, taken out of the race. In the five years (1861 to 1865) the average annual import of wheat was 24,902,576 hundredweight, and from 1866 to 1870 it was 31,807,745 hundredweight. The quantity received from Germany remained almost the same in the entire period, but the failure of the United States was in part made good by Russia, and in part by other countries of Europe, from which a small and somewhat unusual supply had been counted upon in the years past. The sudden appearance of these comparatively new sources of wheat, and their equally sudden disappearance, mark the exceptional conditions that gave them a temporary importance.

* Fiscal years, from Commerce and Navigation.

† Calendar years, from English trade returns.

YEAR.	Imports of wheat into the United Kingdom from			
	France.	Austria.	Turkey.	Chile.
	Cwt.	Cwt.	Cwt.	Cwt.
1861.....	783,913	378,244	1,005,768	178,980
1862.....	974,285	785,451	1,759,411	284,735
1863.....	147,481	72,722	415,519	281,229
1864.....	587,105	11,041	482,994	190,881
1865.....	2,252,873	579,280	574,185	144,861
1866.....	3,473,130	1,326,529	528,433	308,810
1867.....	597,405	542,635	2,446,638	1,946,227
1868.....	56,414	1,004,701	3,066,597	1,309,575
1869.....	468,274	1,030,563	2,379,906	567,107
1870.....	253,644	60,472	489,421	599,337

Had this situation been discussed in the year 1866 or 1867, the critic might have concluded that America and Egypt were destined to fall out of the race as suppliers of wheat, and Russia, France, and Chile were to be the future wheat-growing countries. Two years later a new arrangement would have been found necessary, for Austria and Turkey, the United States and Egypt were the rising countries. So uncertain is a conclusion based upon a limited examination. Neither combination of countries would have been accurate, for the decade 1870 to 1880 wrought a revolution in wheat production the true extent of which it is even now difficult to appreciate, and the effect of which is yet felt. A blow was struck at European wheat interests from which they have never recovered, and from which the probability is they never will recover. This revolution may be studied in clear outline in the conditions in Great Britain.

The last vestige of a duty on imported wheat in the United Kingdom was removed in 1869. The duty of 1s. per quarter, which had been collected since 1849, could not have exerted any influence in encouraging the culture of wheat in the kingdom. In 1867 the acreage under wheat was 3,367,876 acres, and the deliveries of wheat in 170 towns, as reported to the Government, were 2,724,673 quarters. The price of wheat as given in the gazette was such as to encourage some expansion of acreage, but in two years prices again tended downward, and acreage was contracted; so that in 1875 the acreage returned was 3,342,481 acres, and the deliveries were 2,515,098 quarters. To that year the conditions appeared normal so far as the home wheat interest was concerned.

A very different story is told by the imports. From 1871 to 1875 the average annual import was 43,756,956 hundredweight, and from 1876 to 1880 it rose to 52,696,932 hundredweight, or more than double the average import for 1861 to 1865. So large an increase in demand could not be met by continental Europe, though Russia did respond for two years, and at a rate which prom-

ised much. In 1871 Russia gave 15,654,000 hundredweight, and in the following year 17,855,658 hundredweight, a figure that was not again attained until 1888. This effort was all the more necessary, as Germany cut down her quota of supplies from an average of more than 6,000,000 hundredweight a year to one of 3,000,000 hundredweight, and after a slight recovery in 1877 and 1878 began to fall rapidly in the rank of wheat exporters to insignificance after 1880. Thus, at a time when England required larger supplies of foreign-grown wheat, Europe failed her. From 1871 to 1875 Europe gave an average of 18,138,823 hundredweight, and in 1876 to 1880 only two thirds of that quantity, or 12,806,670 hundredweight. Outside of Europe must be looked upon to make good the growing deficiency of European supplies.

The reason of this change of sources is not far to seek. The land in Great Britain could be turned to more profitable use than for wheat-growing. Writing in 1878, before the full force of the current in agriculture could have been felt, Sir James Caird said: "Excluding good lands capable of being rendered fertile by drainage, we appear to have approached a point in agricultural production beyond which capital can be otherwise more profitably expended in this country than in further attempting to force our poorer class of soils. It is cheaper for us as a nation to get the surplus from the richer lands of America and southern Russia, where the virgin soil is still unexhausted; or from the more ancient agriculture of India, which, with its cheap and abundant labor more skillfully applied, and its means of transport extended and better utilized, seems destined to become one of the principal sources of our future supply of corn (wheat)." *

At the time this was written it was assumed that the cost of transporting a bushel of wheat from a distant country was about the same as the rent paid by the wheat farmer in Great Britain. Given ordinarily good returns, the home-grown wheat could meet the foreign wheat on an equality. Two circumstances combined to destroy this relation. The one was an extraordinary succession of bad seasons in England, and the other was such a development of production abroad as to result in a permanently lower range of price. This situation brought to bear an enormous pressure on agricultural properties, and a tendency to reduce rents.

The first notable drop in the wheat acreage in England occurred in 1876, and was due to the great floods in the autumn seedtime of 1875, which prevented a considerable proportion of the land being sown.† In 1874 the acres returned under wheat were 3,391,440; in 1875, 3,128,547; and in 1876, only 2,823,342, a loss in two

* Caird. *The Landed Interest*, p. 6.† *Ibid.*, p. 9.

years of one sixth of the area. There was a recovery of about 200,000 acres in the years 1877 and 1878, but not only was this recovery lost in 1879, 105,000 acres more went out of wheat cultivation. The crop returns of these years tell a doleful story. In 1875 they reported "much under average"; in 1876, "under average"; in 1877, "much under average"; in 1878, "over average"; and in 1879, thought to be the culmination of a series of bad years, "much under average." From 1866 to 1870 the average yield per acre was $26\frac{1}{2}$ bushels, but from 1875 to 1880 this average was twice touched, and in 1879 the complete returns gave a yield of only 18 bushels to the acre, a record that marked a year of disaster.

It will be of interest to show how far these adverse conditions were due to natural causes, and therefore beyond the power of farmer or legislator to modify or even to forecast. The weather of 1875 was "cold, ungenial, and unsettled. The spring was one of the coldest, bleakest, and most backward of the century. In July came heavy, chill, and destructive rains, destroying the hay and the roots, and blighting the prospects of any abundant corn crops." * In the next year, 1876, the hot weather of June and July came too late to mature the crops, and the result was not satisfactory—a crop "of a very imperfect character." †

Conditions were brighter in 1878. The crop was only an average one, but that seemed grateful to the farmers after three bad harvests in succession. Whatever hopes were raised by favoring markets and improved returns were dashed in 1879, a year of disaster in agriculture, and giving the worst crop of wheat since 1816.‡ As agriculture represented one tenth of the total produce of the country, and hardly a branch of agriculture escaped injury, the mischief was so pronounced as to call for an examination by a royal commission. The London Statist, a conservative and able judge, thus summed up the agricultural operations of 1879, a year that many thought marked the total ruin of the British farmer: "There can be no doubt as regards the corn crops that last season was one of the worst on record. After the harvest each succeeding estimate of the yield of the wheat crop appeared to be worse than its predecessor, and these low estimates have been fully confirmed by the remarkable falling off in the quantities brought to market. The reduction of yield must have been at least thirty per cent below the average. . . . The barley harvest has also been most deficient, the result being peculiarly disastrous to the excise revenue. In minor crops, such as hops, there has been quite as serious failure. The season has also been far from favorable to green crops and live stock."*

* London Economist, March 11, 1876.

† Ibid., March 10, 1877.

‡ London Times.

* Statist, January 31, 1880.

It is not to be denied that other causes contributed to depress agriculture in England—causes which operated on every form of industry and commercial activity. The Franco-Prussian War checked exports to two very good customers of English industries; the financial crisis of 1873 was world-wide in its influence; in 1875 came the collapse of many foreign loans, ending in default, ruin, and great suffering to the many who had put their savings into such risks. In 1877 Russia and Turkey went to war, one of the effects of which was to close the ports of both countries and thereby lessen the quantity of wheat exported. In 1878 the City of Glasgow Bank failed and produced a commercial crisis—the last of the important events before the revival of trade and industry began to make itself felt in 1879. But it was the climatic conditions that weighed most heavily upon the farmer, preventing him from meeting his losses, or even from putting himself in a condition to meet the competition of the foreigner. He no longer enjoyed a natural protection of distance. That margin had long since been wiped out by falling prices in the home market, in the places of production, and in the cost of transportation. In 1872 the gazette price of wheat was 57s. the quarter, and the quotation did not fall below 55s. until 1875, when 45s. 2d. was given—a low return in comparison with the previous ten years. A rise brought it up to 56s. 9d. in 1877, but a fall to 46s. 5d. in 1878, severe as it was, gave a price that has not since been recorded. From that year the market value of wheat steadily declined.

The English farmer thus contended against a double pressure—bad seasons and a foreign competition that was in a position to dictate prices. Against both he was powerless, though he could break the full force of the blow from competition by changing his culture, as in growing barley in place of wheat, or by more carefully selecting his lands, and appropriating them to the most distinctly suitable form of crop. As a fact, these measures were adopted on an extensive scale. In England the period 1870 to 1879 gave a decreased acreage under wheat of 529,000 acres, and an increased acreage under barley of 229,000 acres.

At the instance of the royal commission, two of its members visited the United States, and in an able report gave figures to prove that wheat could not be grown in the United States in an average of years and delivered in Great Britain much below 48s. a quarter. This would have been comforting had it been capable of demonstration. Unfortunately for the farmer, the market quotations and the import movement of wheat directly disproved such a hard-and-fast limit. The highest authority on agriculture, Mr. Caird, reiterated his warnings of continued pressure: "Our system of agricul-

ture is thus already beginning to accommodate itself to the change which American competition will certainly render necessary. In the northern and western parts of the country, where live stock predominates over corn, and where the labor bill is comparatively moderate, the effects of this connection are little felt, and the suffering that has arisen of late years has been more the result of ungenial seasons and grazings unthrifty for the herds and flocks. In the corn districts the loss has been greater, because not only were the crops inferior, but prices were low, while the labor was very costly. In the least fertile tracts of poor clay, where every operation is expensive and the land is unkindly for grass, it must either go out of cultivation or be turned to some other purpose than that of growing food. It is hopeless to expect that such soils can maintain their old position. Indeed, nothing but the greatest prudence and freedom of action will carry our landowners and farmers, on even the better class of corn lands, through the earlier years of the competition on which they are entered." *

The estimates of the losses suffered by the British farmer through the succession of "calamitous" seasons from 1873 to 1879 varied widely, but all agreed in naming a very large amount. Only two good crops in ten years, and the last of the series, that of 1879, the "worst of the century," naturally gave a severe and, as it proved, a lasting blow to wheat-growing in England. Indeed, the loss was placed at one third of the total farming capital of the kingdom, and in many corn (or wheat) districts more than one half of the farmers' capital had disappeared. The acreage under wheat, the gazette price, and the imports of foreign supplies during this period make an interesting and suggestive study.

YEAR.	Wheat acreage.	Gazette price per quarter.		Total imports.	Imports from Europe.
	Acres.	s.	d.	Cwt.	Cwt.
1871.....	3,571,894	56	8	39,389,803	20,667,593
1872.....	3,598,957	57		42,127,726	26,543,585
1873.....	3,490,380	58	8	43,863,098	14,392,135
1874.....	3,630,300	55	8	41,527,638	10,109,357
1875.....	3,342,481	45	2	51,876,517	18,981,444
1876.....	2,995,957	46	2	44,454,657	13,208,705
1877.....	3,168,540	56	9	54,269,800	19,642,475
1878.....	3,218,417	46	5	49,906,484	14,614,540
1879.....	2,890,244	43	10.	59,591,795	11,908,821
1880.....	2,909,438	44	4	55,261,924	4,658,807

These figures alone would be sufficient to indicate a revolution in the wheat interests of Great Britain. The acreage under wheat

* Address as President of the Royal Statistical Society, 1880.

decreased nearly one fifth, yet the price of wheat fell in more than the same proportion. The supplies obtained from European countries fell off in quantity, and would, indeed, have fallen to nothing had it not been for Russia. With her black-earth region, rapidly settled by her own population, she was in nearly the same position as the United States, and responded for a time freely to the demands of the English market.

The economic movement thus fixed upon English wheat interests by adverse conditions proceeded rapidly in the ten years following 1880, and the great changes occurred not in England itself, but in the development of competition among outside growers of wheat for export. In 1880 and 1881 it seemed as if the United States held a practical monopoly of the British wheat market. In these years nearly two thirds of the total imports came from the United States, and British India was the only competitor in sight, but far behind America in importance. The quantities of wheat taken from our producers have never since been equaled, and still stand as the record years in this one line of exports. For the rest of the decade the movement fluctuated within wide limits, and it seemed at times as if the position of American wheat in England was seriously threatened. Russia showed a remarkable increase in an ability to export, while British India, its own population not being consumers of wheat, was thought to offer an almost unlimited field for wheat culture and commerce, limited, in fact, only by the difficulties of assuring certain water supply and ready means of transport. A new and not unfavored competitor gave signs of activity in Australasia, while before the year 1890 experts were speculating upon the possibilities of Argentina as a wheat country. Europe, outside of Russia, was practically out of the race; but that loss was more than made good by so many new countries coming forward with a promise of abundant and cheap production. The former table on acreage and price in England is here continued for the decade 1881 and 1890:

YEAR.	Wheat acreage.	Gazette price per quarter.		Total imports.	Imports from	
					Europe.	Russia.
	Acres.	s.	d.	Cwt.	Cwt.	Cwt.
1881.....	2,805,809	45	4	57,147,933	5,680,921	4,046,849
1882.....	3,003,960	45	1	64,240,749	13,511,881	9,575,632
1883.....	2,613,162	41	7	64,138,631	18,523,701	13,346,762
1884.....	2,677,038	35	8	47,306,156	7,344,097	5,402,396
1885.....	2,478,318	32	10	61,498,864	15,778,873	11,975,644
1886.....	2,285,905	31		47,438,806	5,840,829	3,720,662
1887.....	2,317,324	32	6	55,802,518	7,796,303	5,501,380
1888.....	2,564,237	31	10	57,261,363	26,880,596	21,450,346
1889.....	2,449,354	29	9	58,551,887	28,649,886	21,320,304
1890.....	2,386,336	31	11	60,474,180	26,473,442	19,389,025

Interesting as has been the record of wheat imports into the United Kingdom for the twenty years from 1871 to 1890, the course of events since has been sensational in their number and suddenness. The famine of 1891 in Russia crippled her export trade for the time, and, indeed, threatened to destroy it by the necessity of creating deposits of grain to guard against the recurrence of so dread a visitation. A series of poor crops in India raised domestic prices of grains to a point at which shipments became unprofitable, and this weakening of wheat supply culminated in the plague and famine which wiped Indian wheat out of the European market. Argentina began to fulfill its promise of production, and after a meteoric progress collapsed in disaster, its entire crop being destroyed by a plague of locusts. Russia and the United States alone remained as a source of supply, and under the stress of demand the price of wheat rose rapidly in 1897. These various conditions may best be related in the next article.

The English wheat acreage meanwhile has gone steadily down under the strain of outside competition. In 1895 only 1,417,483 acres were returned as under wheat—a loss of nearly 2,000,000 acres since 1867. The prediction that the United States could not export wheat under 48s. per quarter has been answered by continued export with wheat at 22s. per quarter. A royal commission on agriculture can make no definite suggestion for its betterment, and the following tables express more eloquently than could any words the kaleidoscopic changes in sources of imports since 1890, all of which have depressed wheat-growing in England, while shuffling these outside sources of supply in a manner truly remarkable. As a record of sudden change, these figures could hardly be matched in recent economic experience:

YEAR.	Total imports.	Imports of wheat into the United Kingdom.			
		From Europe.	From India.	From United States.	From Argentina.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1891.....	66,312,962	18,126,326	13,005,785	24,194,945	2,478,456
1892.....	64,901,799	6,290,313	12,495,442	33,886,742	3,466,096
1893.....	65,461,988	10,619,692	6,196,096	32,262,848	7,845,587
1894.....	70,126,232	17,958,758	5,349,056	24,658,245	13,272,152
1895.....	81,749,955	27,095,355	8,802,950	27,084,120	11,400,360
1896.....	70,025,980	26,674,110	2,112,940	30,694,900	4,927,600
1897.....	62,743,280	19,470,280	572,760	34,603,200	933,100

A period of stress such as English agriculture has passed through leaves its permanent results, and the social changes wrought in the British Islands have been great and trying. The landowner has seen his rents fall to a point below which no profit can accrue from

keeping his lands under wheat. The land occupier has seen his profit wiped out, and has been forced to obtain a reduction in rent, or to migrate to the towns, colonies, or foreign countries. The farm laborer, never in even a good position, has found precarious work, and has become migratory in his restlessness. This has been followed by a rise in wages, through the scarcity of farm hands, but the employers complain that under higher wages less and therefore more costly results are obtained. The value of land in the return for taxation shows a great shrinkage. In 1872 the value of lands in England so returned was £48,964,149, and it increased each year, reaching a maximum of £51,811,234 in 1877. In 1895 it had fallen to £39,680,346—a decrease of twenty-three per cent, or nearly one fourth. This becomes the more striking when compared with the rise in the value of houses from £76,475,194 in 1872, to £133,511,890 in 1895. From these figures it may be judged how severe has been the crisis in English agriculture, yet a crisis that has not permanently increased the cost of wheat and thus burdened the other industries of the empire.



A SPRING VISIT TO NASSAU.

BY EMMA G. CUMMINGS.

WITHOUT indulging in too familiar details of an ocean voyage, let me briefly sketch some interesting features of my visit to Nassau in the month of March, for the island of New Providence is unique and interesting on account of its wonderful flowers and trees as well as the curious customs of its picturesque natives.

One interesting bit of the voyage from New York was the sight of the "Sargasso Sea," which we reached the third day out, after crossing the Gulf Stream. We came upon water of an intensely dark, indigo blue, filled with lovely delicate floating seaweeds, such as we had never seen before. It seemed impossible to believe that the water itself was entirely colorless, and one young lady on board insisted that the captain must be wrong in saying it was the same as the rest of the ocean; whereupon the captain ordered a bucketful to be dipped up, when it was found to be no bluer than the rest.

The next day we reached Nassau. Clad in our thinnest summer clothes, we left the steamer outside the bar and were taken on a tender up to the wharf, where the usual crowd of natives had gathered to see us land. For the most part they were a leisurely and good-natured lot of colored people, for negroes far outnumber the whites. Looking over the rail on the other side of the tender, an

unusual sight met our gaze. A dozen or more boys in small boats, scantily clad, were clamoring, "Boss, please now a penny!" and as the passengers threw small coins, the nearly naked boys dived for them into the exquisitely clear green water, often catching them before they reached the bottom. They are expert swimmers, as the following story will show: A few years ago a wrecking crew was ordered from New York to take the cargo from a sunken vessel; but, before they arrived upon the scene, the natives had descended to the hold of the vessel with grappling irons, attached them to the cargo, and raised it.

As soon as we landed, our baggage was examined by the custom-house officers—important-looking colored men dressed uniformly in dark-blue trousers, with a red stripe down the side, white linen jackets, and white pith hats. Boys of every age and various cast of features, showing their gleaming white teeth, begged to take our parcels to the hotel. As we sat in the cage-like shed which serves as a customhouse we were at once impressed with the sense that the island of New Providence was indeed a foreign land, most picturesque, fascinating, and distinctly tropical, with its tall cocoa palms here and



COCOANUT PALMS.

there waving above the other trees and the house-tops. Our attention was particularly attracted to the trees about the wharf and along the main street. At first we thought they were magnolias, and it was hard to believe they were not members of that family, so striking a resemblance do they bear with their large, shining leaves. They are known as almond trees, the Demerara almond (*Terminalia catappa*), but are not the almond of commerce.

A conspicuous tree, resembling the pine, is the cassowary

(*Casuarina equisetifolia*), so called from the likeness of its long, delicate branches to the hair of the cassowary, and *equisetifolia*, because its stems and leaves are like our common weed *equisetum*, or horsetail. This tree is a native of the East, and is introduced now



CASSOWARY TREES, BAY STREET.

through all tropical countries. The button tree (*Thespesia populnea*) is thus called from its buttonlike fruit, and is common about the town.

The vegetation was new and curious to our Northern eyes, each step revealing plants and trees hitherto unknown. How to know them was a problem, because we were interested in these beautiful surroundings, but could find no one who could give us reliable information. A few plants that were familiar to us in greenhouses in the North grow in Nassau as common garden plants. Some that we recognized were the poinsettia; oleanders, growing to the height of twenty-five feet, with flowers varying from white to pink and deep crimson; hibiscus, with hundreds of blossoms on a single shrub;

castor beans, morning-glories, lantanas, four-o'clocks, and tecomas, with their white and yellow blossoms, at this season the most conspicuous wild flowers; and the life plant (*Bryophyllum calycinum*), a single leaf of which, if pinned to the wall of a room, will send out rootlets and grow. These last are seen in every direction, and grow wild among the rocks. Orchids, air plants (epiphytes), and palmettos, which are so carefully cherished in our hothouses or homes, here run wild and cover large areas of waste land. Cacti, agaves and aloes are common, and from them good commercial fibers are made. Sisal hemp and sisal grass are terms used for fibers of probably more than one species of agave. They have always grown wild on the islands, and were formerly considered a nuisance. Of late years the production of sisal has formed a large industry, and hundreds of acres are given up to the growth of the plant, which thrives on the poorest soil. The cultivation of sisal is only exceeded in extent by the sponge industry, in which six thousand people and a great many small vessels are engaged, Nassau being the principal port for sponge trading in the West Indies. The men engaged in gathering the sponges go off on cruises of five or six weeks. They get the sponges by means of a hook attached to a long pole, and then leave them in the sun till the animal matter decays. They are then brought to the sponge exchange, sold in large quantities, and afterward taken by each buyer to his wharf. Here women are employed in cutting, trimming, and packing them for exportation.

In early spring, before the trees put forth their leaves—for there are many deciduous trees even in a tropical region—there are fewer flowers in bloom than later in the season. Some have their season of growth and rest, though the climate has a nearly equal temperature throughout the year, while other trees and plants, like tea and coffee, produce several crops annually. In tropical regions, sequence of crops depends largely upon a rainy and a dry season. The absence of grass is quite noticeable. Very few cows are kept, and this has its effect upon food, as condensed milk must always be used. A tree of great interest, particularly to those interested in the dissemination of seeds, is the sand-box (*Hura crepitans*). Its pods explode with a pistol-like noise, scattering the seeds to a great distance. I secured a good specimen, and packed it carefully in a box. Some five or six weeks later, when at home, I untied the pod and put it on the table with a collection of corals, shells, and curios from the West Indies. Coming home one day, I was told that it would be unsafe ever to go out again and leave Sam, the pet cat, alone in the sitting room, for he had been on the table and made great havoc, scattering sponges, shells, etc., all over the room. I rushed to see if any of my specimens had suffered, and found that not Sam, but

the sand-box, had been the cause of the disaster. Travelers relate many interesting and curious stories about the sand-box.

One day, seeing some curious-looking pods in a store, we inquired where they grew, and were directed to the yard of a good-natured and amiable negro woman. She designated two large trees as the King and Queen; a very pretty idea, since they are dioecious—that is, one bears unfertile or staminate flowers only, and corresponds to the male, while the other bears fertile or pistillate flowers only, and corresponds to the female. The latter is the pod-bearing tree,



MONKEY TAMARIND TREES.

and the smaller of the two. The trees are very old, one having a girth of twenty feet at six feet from the ground. Its name, monkey tamarind (*Adansonia digitata*), is given from the fact that in Jamaica monkeys are sometimes caught while attempting to obtain the seeds from the large woody pods which the tree produces. The true tamarind (*Tamarindus indica*) of the West Indies is also a large tree with delicate spreading foliage, and is distinguished by its brown leguminous pods. We bought these at the market and ate the acid pulp which surrounds the seeds. With the aid of sugar it makes a palatable drink. When sold for commerce, and used for medicinal purposes, the pods are removed, but the seeds remain connected together by a fibrous string. There are several species

of trees in Nassau belonging to this same family, the *Leguminosæ*, having pulselike fruit, as the sweet pea and honey locust, although the pods vary greatly in shape and size. One of these, that loses its leaves in the winter season, has hanging upon its branches a great number of delicate pale-yellow pods, about eight inches long, which, swaying in the wind, so fill the air with a soft, murmuring noise that it has been called the singing tree (*Albizzia Lebbek*). They are plentiful about the town. Another species (*Poinciana pulcherrima*), nearly related to the sensitive plant (*Mimosa*), also loses its leaves in the winter, but bears pods quite different in appearance. These pods are long, some measuring twenty-four inches, dark-colored, even almost black. A fine group of these trees surrounds the library building. A few vines belonging to this family are interesting, especially the *Abrus precatorius*, or wild licorice. Twining over the tops of the trees, it produces small pods growing in clusters, in which are bright-red seeds with a black spot on one end. These seeds are known to almost all children as Guiana peas or "Black-eyed Susans." They have been extensively used for ornaments in shell work, and it is not uncommon to hear people say they thought they were a kind of shell or some part of one, so associated are they with such work. Then there is the nicker (*Guilandina*), a prickly trailing shrub. We were told that boys take the yellow or olive-colored seeds from the flattened prickly pods and use them instead of marbles for playing games. There are pods of an innumerable variety of shapes and sizes, some that twist in opening, others that curl—in fact, pods of every description are to be found in this region.

The most remarkable tree on the island of New Providence is without question a specimen of the silk cotton (*Bombax Ceiba*), situated near the post office and prison. Growing from its trunk are half a dozen buttresslike extensions, as if to make a firm footing for its great spread of branches of one hundred and sixteen feet. A little boy, to whom I showed a photograph of it, expressed its appearance very well when he said the spaces between the buttresses would make fine horse stalls. The pods which grow on the tree contain a soft, silky material which the natives sometimes use for stuffing pillows. There are more of these trees, but none so large or old as this one, and we heard no estimate of its age. It is a near relative of the monkey tamarind. Between this *Bombax* and the library is an avenue of Spanish laurel, a member of the fig family—untidy and inelegant trees, with a growth of roots hanging from their branches which never reach the ground. We saw in the hospital grounds a specimen of the same family, which is called the wild fig. About three miles from Nassau is another species of fig, errone-

ously called *Ficus indica*, or banyan tree of India. It has the same habit of growth as the banyan, sending down fibers which sink into the soil. These fibers take root, and in turn become parent trunks, shooting out new branches, which in time suspend their roots, and these, swelling into trunks, produce still other branches. All these trees bear fruit, but the figs are small and unfit for eating. *Ficus carica*, the fig of commerce, and the India-rubber tree belong to the same family, and are all characterized by a milky juice. On these islands there are large timber trees, including, among others, the mahogany, mastic, *lignum vitæ*, etc. Some trees, like the cinnamon, are valuable for their bark; others, like the logwood and fustic, are useful for their dyes. On one of our several pleasant excursions we drove through the pine woods and palmettos to Lake Killarney. Here we saw the only species of pine growing on the island (*Pinus bahamensis*), and along the roadside we noticed the beautiful and conspicuous shrub, the sappens (*Chrysophyllum oliveforme*), with its shining green leaves above, and below a down of rich golden-brown color. The shores of the lake are lined with mangrove trees, which send out ærial roots from their branches. They descend in arched fashion, strike at some distance from the parent stem, and send up new trunks, spreading like the banyan. The south shore of the island is also overrun with the mangrove, the salt water at high tide surrounding many of the bushes, giving a curious effect for miles along the shore.

Other excursions that we took included the bathing beach, the caves to the west of Nassau, and the remarkable Lake of Waterloo, which should be visited after dark in order that its wonderful phosphorescence may be seen. The greatest charm and wonder was a sail of three to six miles to the sea garden. Leaving the sailboat, we stepped into a dory with a glass bottom, through which the mysteries of the deep were as plainly seen as if only at the depth of a pail of water. On the white sand, fifteen or twenty feet below us, we saw coral, sea fans, and sponges, while exquisitely colored fish darted in and out among the waving forms of life.

Several times in the early morning we visited the market, which is of great interest. Here it is not infrequent to see three or four tomatoes, as many onions, and a little piece of garlic arranged together on a barrel head. The sale of two or three such lots constitutes a day's business, for the needs of the people are small. The natives walk from the surrounding country to the city, bringing the fruit in baskets or trays balanced on their heads. The sapodilla is one of the cheapest and most abundant of fruits. The tree is very handsome with its glossy foliage, and freely bears a chocolate-colored fruit about the shape of a peach and as variable in size. These

are usually sold for a few cents, often being placed in small lots upon the ground or sidewalk. Any one wishing to buy a bushel of them, or, in fact, any other fruit, must visit half a dozen places in order to secure the quantity desired. Unripe cocoanuts are highly in favor. After the fluid with which the nut is filled has been drunk, the albumin or jellylike substance is eaten with a spoon. Hence the term "jelly cocoanut." These can not be procured from the tall trees, as the method of gathering the ripe fruit would break those that are unripe. Boys climb the tall, straight trunks and



A STREET IN NASSAU.

throw down the ripe fruit, which does not crack, or it is sometimes allowed to remain until it drops of itself. It is usual to pay the boys by giving them two out of every dozen. Sweet potatoes and yams are used extensively for food, and both are said to contain more nutriment than the common potato. The sugar cane, from eight to ten feet in length, is often seen in the market. A native referring to it will say that he has had a "long breakfast." Bananas, plantains, and oranges are among the most abundant fruits. The banana

and plantain were formerly considered as distinct species, but now the plantain is regarded as a variety of the banana (*Musa sapientum*). The name of the plantain (*Musa paradisiaca*) originated with the Christians in the East, as they thought it to be the forbidden fruit of paradise. The plantain is cooked and eaten as a vegetable, but is not exported to any extent. It is said to be "to the inhabitants of the torrid zone what bread and potatoes are to those



BUYING SWEET POTATOES.

of the north temperate zone," for a pound of plantains contains more nutriment than three pounds of meat.* It is also the most prolific of all food plants known. Humboldt, the German naturalist, calculated that thirty-three pounds of wheat and ninety-eight pounds of potatoes require for their growth the same space of ground as will produce four thousand pounds of bananas. Such a striking statement would seem to need verification, yet the yield is undoubtedly very great. The banana plant rises from fifteen to twenty feet in height, terminated by a tuft of enormous light-green leaves six to ten feet long, which are at first undivided, but are gradually split up by the wind. From the center issues a stalk bearing the fruit, which gradually turns upward, while the stalk itself continues to grow down, and this end is termed the "banana bob." As we are accus-

* Text-book of Tropical Agriculture. By H. A. Alford Nicholls.

tomed to seeing the bunches in shop windows or in the markets, they are suspended in the direction opposite to that from which they grow. The orange, one of the most important of all fruits, and its allied species, lime, lemon, called there "sour," grape fruit, and shaddock, grow abundantly on the islands. The orange tree is the hardiest member of the citrus family, and is raised farther north than most fruits that grow in the tropics. There is a variety known as the sour orange, some plants of which have become wild, and are known as bitter-sweets. They are very juicy, and have a slight acid flavor. We bought fruit of a greenish color, which did not look ripe, and certainly did not taste as agreeable as the rich golden kind we are accustomed to. It is a mistake to say that oranges are no longer raised from seeds, for that is the customary method of propagation throughout the West Indies. The cultivation of the pineapple is one of the industries of the Bahamas, but they are not grown to any extent on the island of New Providence. The decomposed coral rock of these islands is a favorable soil for their cultivation. They grow singly upon plants which attain an average height of about a foot and a half, and have long, narrow leaves with sharp, serrated edges. Consequently, the men, women, and children working among them are obliged to protect their legs with strong canvas leggings, and their hands with heavy gloves, to which gauntlets are attached. We bought soursops, custard apples, and star apples in the market. Many other fruits that grow on this island were not ripe at the time we were there. They include watermelon, pumpkin, alligator or avocado pear, guava, groundnut or peanut, papaw, seaside grape, cocoa plum, cucumber, rose apple, breadfruit, egg plant, cashew nut, and mammee. Owing to the rapid ripening and decay of these fruits after being picked, it is almost impossible to export them with success. Pineapples, oranges, bananas, and cocoanuts are the principal fruits that are exported; the two latter, with plantains, can be obtained throughout the year. Most of the fruits grow spontaneously, but the breadfruit has been introduced. In 1787 the English Government sent the bark *Bounty*, commanded by Captain Bligh, to take young trees of the breadfruit from Otaheite to the West India Islands. Owing to the mutiny of the crew, the transfer of the trees was not accomplished till several years later.

One of the first questions we would ask our guide and driver when we saw a new fruit was, "Is it good to eat?" On one occasion, referring to the sailor's apple, he said, "If yer eat it, it'll do yer up"; of another he said, "It'll put yer in yer grave." The seaside grape, sailor's apple, and many other trees and shrubs that grow in barren or exposed places have their leaves standing vertically, so

that less surface is exposed to the direct rays of the sun. The result is that such trees give but little shade, as the light is not interrupted in its passage to so great an extent as it is by the leaves of ordinary



NATIVE TWINS.

trees. In situations where it is necessary for plants to economize their water supply and prevent undue evaporation, they adapt themselves in various ways for this purpose. Some grow thick, leathery leaves; others have a waxlike or hairy coating; and still others, like the cacti, have thick, succulent stems in the place of leaves. Many of our own desert or seashore plants have adopted one or more of these methods.

The soil, though thin, is fertile, but there are no streams of running water on any of the Bahama Islands except that of Andros. The streets of Nassau and the roads of the surrounding country consist of the coralline rock which underlies the soil. They are white and dazzling, and are kept in repair by the Government. The work is done usually by the prisoners, dressed in prison garb of blue and white striped cotton. The coralline rock is porous and looks not unlike the result of volcanic action. In some places the rocky ground is honeycombed with holes three to ten feet deep, called "pot-holes," in which bananas, especially, like to grow. On the deep sides of one hole we saw a luxuriant growth of delicate ferns.

We found the natives very much afraid of a camera, believing

that it was the Evil Eye fixed upon them, so that many a good opportunity for a snap shot was lost by the sudden hiding or covering of the face of the picturesque negro. Sometimes they could be persuaded for a penny or two to grant one's request to "wait a minute." In some cases, discovering that they had been "took," they would ask for a penny indemnity. One day, just as I was about to photograph two little children, the angry mother appeared, severely scolding because some one had not bargained for a penny. The small children are scantily clad with a single garment, while the women wear white calico dresses, white aprons, and bright-colored plaid handkerchiefs tied around their heads under straw hats. They may or may not be barefooted. The homes of these people are picturesque, especially in the village of Grantstown, where the little huts, often thatched with palmettos, nestle among luxuriant tropical gardens, and the cocoanut palms wave above bananas, oleanders, datura, and sapodilla trees. The houses have no glass in the windows, but instead have shutters with bars, which are the only means



NATIVE HUT, GRANTSTOWN.

of closing the windows. There are never chimneys, for the cooking is all done out of doors, a black pot, with legs suspended over a fire of fagots, serving for general use. Men, women, and children speak to travelers, and expect a word of recognition in return. When

we had taken our last drive, my companion gave our driver a small fee, saying that it was because he was such a good botanist, for he really had been able to tell us the popular names of many plants. He laughed, and as he seemed so much pleased, I said, "James, I suppose you know what botanist means?" "Yes," he answered, "I 'spose it's some kind of a good boy."

MIGRATION.

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IT is easy to understand how natural selection may modify organisms for the good of the species, even at the expense of the individuals which, in each generation, make up the species; but it is difficult to understand how this can be brought about by nurture, for, so far as the direct action of the conditions of life is concerned, the species is identical with the sum of the individuals which now exist. No illustration of the law that the adaptations of living Nature are for the good of the species, and that when this comes into conflict with the welfare of the individuals, these are sacrificed, is more simple or more easy to understand than that afforded by some of the phenomena of migration.

The young salmon which is born in a mountain stream is soon impelled, by something in its nature, to journey downward, even for many hundred miles, until it reaches the unknown ocean, where it would discover, if it had faculties for anything so subjective as discovery, that, while it was born in a little brook, it was made for life in the great ocean. It has brought from its mountain home a natural aptitude for eluding all the strange enemies and for avoiding all the novel dangers which it meets in this new world, and it leads an active, predatory life, fiercely pursuing and destroying its natural but hitherto unknown prey; for growing rapidly, and quickly acquiring all the characteristics of the adult salmon, and storing up the intense nervous energy and the muscular strength which will be needed for forcing its way up the rapids in the mountain torrents, for leaping waterfalls, and fighting for its passage, where it long ago darted down with the current. As sexual maturity approaches, some stimulus, which has its origin in the developing reproductive organs, impels it to leave the ocean and, entering the mouth of a river, to journey upward, often a thousand miles or more, to its sources in the mountains.

At this time the king of fishes, as it is well called, is in physical perfection, with few rivals in beauty or strength or fierce energy, or

indomitable courage and perseverance; but its strength is soon fully taxed in surmounting the obstacles and in fighting the rivals which oppose its progress, until at last, worn and thin, torn and mangled by battle, and battered by rocks and whirlpools, with its skin in rags, its fins crippled and bleeding, and its whole body from nose to tail bruised and emaciated, nothing of its kingly nature remains except the indomitable impulse, which no hardship can quench, still urging it upward, until, if any life is left, it at last reaches the breeding ground.

One of the most magnificent species of this kingly genus was so abundant in the Columbia River before canning houses had reduced its numbers, that the town reaches were packed with salmon, while the surface was covered with the drifting bodies of those that had perished in fierce struggles with the crowd; yet there is good authority for the assertion that not a single one ever returns alive from the breeding grounds in the head waters of the St. Cloud. The whole race is wiped out, utterly exterminated, as soon as it arrives at maturity and physical perfection, in order that the perpetuation of the species may be assured. The whole object and end of the beautifully co-ordinated body, which is provided for by such admirable and wonderful adaptations, which is built up so slowly and at so much cost, is rapid and total destruction.

The marvelous instinct which leads the young fish to the ocean, the organization and the habits which fit it for its marine life—all, in a word, which makes of the salmon our ideal of a lordly fish—is worth nothing as compared with the welfare of generations yet unborn.

Scientific men who are not zoölogists are fond of telling us that science has nothing to do with the *Why?* and is only concerned with the *How?* and while this may perhaps be true in the ultimate or philosophical sense of the words, it is often easy in zoölogy to discern why an action is performed, while we are very ignorant of the structural conditions under which it takes place.

As all the individual California salmon seem to act alike, and as the young salmon has no parental instruction, it seems probable that everything it does is the result of its structure or of such nurture as this structure provides for; and yet we may safely say that no one now living is at all likely to discover or to predict its migration from the study of its body, although the reason why the migration takes place is obvious.

Whole books, and not a few of them, have been devoted to learned speculations on the nature of the impulse which leads to the migration of birds, and while the subject is most fascinating, the value of the results has not in all cases paid for the labor.

Newton (*Encyclopædia Britannica*, article *Birds*) says: "We have here more than enough to excite our wonder, and instead are brought face to face with perhaps the greatest mystery which the whole animal kingdom presents—a mystery which attracted the attention of the earliest writers, and can in its chief point be no more explained by the modern man of science than by the simple-minded savage or the poet or prophet of antiquity. Some facts are almost universally known, and have been the theme of comment in all ages and in all lands. The hawk that stretches her wings toward the south is as familiar to the latest Nile-boat traveler or dweller on the Bosphorus as of old to the author of the book of Job.

"The autumnal thronging by myriads of waterfowl of the rivers of Asia is witnessed by the modern sportsman as it was of old by Homer. . . . But there is no need to multiply instances. The flow and ebb of the mighty feathered wave has been sung by poets and reasoned by philosophers, has given rise to proverbs and entered into popular superstitions, and yet we must say of it still that our ignorance is immense."

While this author does not exaggerate either the interest or our ignorance of the life of birds, which goes on in regions that are almost inaccessible and unknown, there is no reason to suppose their migrations are any more mysterious than most biological problems; for the modern man of science is little more able than the simple-minded savage or the poet or prophet to tell how all the co-ordinated faculties of a predaceous animal are so thrown into action by the stimulus of hunger as to lead to the pursuit and capture of prey; yet there is no mystery in the physiology of hunger, for, while there is much we do not understand, we do know that hunger incites actions which are responsive, or adapted for satisfying hunger.

So also it may be possible to make progress in the study of the meaning of migration in spite of our ignorance of the nature of the impulse which excites and determines it; and while I gratefully acknowledge my debt to Newton for the facts, I am not able to agree with him that there is anything distinctively or peculiarly mysterious in the subject.

While there is reason to believe almost every bird of temperate and arctic climates is migratory to some degree, those which simply range over a wider area at one season than at another present nothing notable, and it is only in regions which are almost or quite deserted by birds for part of the year that their migrations attract the attention of students. As many birds which are most valued for food are found in temperate regions for only a short time in the spring and fall, sportsmen and hunters and all who pursue them for food

have been familiar with the habits of the birds of passage from the dawn of history; but most of the best literature on the subject is by northern ornithologists, and the home of the writer has had and still has great influence on opinion as to the meaning and origin of the migratory habit. Scandinavians and Saxons and Anglo-Saxons are home-loving folk, who, in all their wanderings through this world of care, keep a warm affection for the fatherland.

A learned professor in the University of Upsala once wrote a book to prove that the garden of Eden was in Sweden, by the simple argument that no one who knows the delights of that blessed country can believe paradise could have been anywhere else. He showed that the Atlantis of Plato, the country of the hyperboreans, the garden of the Hesperides, the Fortunate Islands, and the Elysian Fields are but faint and imperfect reminiscences of the lovely and favored climes of Sweden, from which the Greeks themselves derived their alphabet, their astronomy, and their religion.

To men of the north, home seems the natural refuge of the birds, and, as much of the literature of migration is northern, the birth-places of common birds have been regarded as their true or natural homes, and while their disappearance in winter has seemed to call for explanation, their return in summer has been looked at as a matter of course, for the intense love of home which many birds have has seemed enough to draw them back as soon as winter is over. It is the "homing" instinct which makes the carrier pigeon so useful to man; and one of the most impressive features of the migratory habit is the definiteness of the journey northward, which often ends in a particular bush or ledge of rocks. Many of our common birds lay their eggs year after year in the same nest, although they spend part of the year in the heart of a foreign country thousands of miles away, and although the surroundings of the chosen spot may have changed so much that it is no longer a judicious selection. A bottle in the branches of a tree at Oxbridge, in England, is known to have been occupied every year, with only one exception, since 1785, by a pair of blue titmice; and on a hill in Finland, well known to tourists as the most northern point in Europe where the sun can be seen at midnight, a nest is said to have been occupied by a pair of peregrine falcons every year since 1736. Many like cases are recorded, and while it is not probable that the birds which visit a nest year after year for centuries are the same, the fact is all the more remarkable if they belong to successive generations.

According to folklore, some of the summer birds hide near home through the winter, and Carus, in his *History of Zoölogy*, refers to several learned writers who, early in the seventeenth century, quoted from the older literature much venerable authority for the belief

that swallows hide through the winter in holes and in clefts in the rocks, and even under the water.

Many writers on migration have believed, as they have been taught from childhood, that the birds go south to escape the rigors of a northern winter, although little reflection is needed to show that no animals are better protected or more indifferent to changes of temperature, or that, while sea birds are highly migratory, the open waters of arctic seas are little colder in winter than in summer. Nestlings are often killed by exposure, and eggs require a high external temperature, but old birds are, as a rule, indifferent to cold.

When this is recognized, the prevailing belief is that birds leave their homes in search of food, for scarcity is most assuredly an important factor in the origin of migration; but this view of the matter fails to show why, with the whole world to choose from, they do not settle in lands which are habitable the year round.

“The shuddering tenant of the frigid zone
Boldly proclaims the happiest spot his own,”

and the return of the birds seems only natural to the Eskimos; but to us who are not Eskimos the wonder is not that anything which can get away should do so, but why the birds pass by so many lovely and fertile regions to seek a home in the barren and desolate ends of the earth; and it is plain that, of the two journeys which make up the migration, the summer visit to northern lands and waters is at least as remarkable and as well worthy of consideration as the journey southward in the fall.

Failure of food in their birthplace is no doubt the chief reason why the migratory birds do not spend the whole year there, and in so far is an explanation of migration, for no animals are better fitted for moving from regions of scarcity to regions of abundance, although they are no more able than creeping things to establish themselves in new lands which are already well stocked with inhabitants; for they are kept within the limits of their natural habitat, like other animals, by competitors and enemies, rather than by physical barriers, although their power to wander and to overcome physical barriers is without a parallel. There are few oceanic islands, however remote, which are not inhabited by land birds descended from lost wanderers, who, finding these spots unoccupied, have been able to establish themselves. The list of North American birds which are occasionally found in Europe is a long one, and stray specimens of the gray plover, whose summer home is the shore of the Arctic Ocean, have been found at the Cape of Good Hope, in Ceylon, in Australia, in New Zealand, and in Tasmania. Most of the wanderers are shore birds which make long migrations, and be-

ing much exposed to storms are often driven far out of their path; but this is not always the case, for the great albatross follows ships across the whole breadth of the South Pacific, or nearly half the circumference of the earth. Many birds seem to make their whole journey by a single flight, for some which are common in the West Indies and in Nova Scotia are almost unknown within the limits of the United States, making the whole journey past our borders by water and probably by a single flight. The bluethroat, which breeds in the northern part of Scandinavia, is so seldom found in Europe south of the Baltic that there seems to be good evidence that it makes its whole journey to its winter quarters in the region of the upper Nile by a single flight.

There is no reason to suppose all migratory birds inherit this habit from a common ancestor, nor that its purpose is always the same, and many birds of prey seem to have acquired it by ranging far in winter in search of food, and by following their prey into warmer regions, to return to their birthplace in the breeding season.

In those cases the birthplace may have been the original home, before the migratory habit was acquired, and scarcity of food the reason why it was acquired; and the influence of scarcity in causing migration is well shown by the occasional or irregular migrations of certain prolific animals which do not ordinarily leave their birthplaces, although, when these become overstocked, migrations take place, just as human colonists go out from thickly settled countries to find new room for growth in foreign lands. From time to time, at irregular intervals, great armies of the smaller and more prolific rodents, which usually spend their lives where they are born, are met on the march from homes where overproduction has exhausted the food; and several of the older American naturalists have described the migrations of our gray squirrel, although the phenomenon has been most carefully studied in the Norwegian lemming, whose remarkable migrations have figured in literature for centuries. The lemming is a small, restless, pugnacious, and very prolific rodent, which at uncertain and irregular intervals of from five to twenty years migrates from its home in the central mountain chain of Norway, and invades the low lands so suddenly and in such numbers that it is still popularly believed, as in the day of Olaus Magnus, who wrote in 1490, to drop from the sky.

The great army of lemmings travels in a straight line and overruns the cultivated country, swimming the lakes and rivers, and causing so much destruction that a special formula to be employed against it was at one time authorized by the Church, which attempted to check its march by exorcism, just as the old Bishop of Montreal tried to drive away the wild pigeons by anathemas. The lemmings

travel at night, but their march is not continuous, for they make long halts in fertile spots, where they are even more prolific than they were at home, so that they become more and more numerous, although they are attended by bears, wolves, foxes, dogs, and cats, and by hawks and owls, and other beasts and birds of prey, and although even the cattle and reindeer are said to kill and eat them. The march may last for several years, but as they never go back, but continue to move forward, they at last reach the ocean, and, attempting to swim this as they have all the rivers in their course, all are drowned.

While the migration of the lemmings is undoubtedly due to scarcity, it is difficult to understand its use, for at the present day the only ones to profit by it are those who have the instinct least developed and stay at home in the mountains, although it may have been useful to the species before the low lands were occupied by man, who now destroys the stragglers and prevents them from scattering and finding permanent homes.

While the determining influence is the scarcity which comes from overcrowding, we have no reason to believe the lemmings consciously and deliberately set out to find a better feeding ground, or that they have traditions of the rich low lands which attract them as the wealth and luxury of China and Mesopotamia and of the Roman Empire attracted the Tartars and Scythians and Goths from the sterile and desolate northern lands into the fertile homes of southern civilization.

Their journeys are no doubt initiated by an unconscious impulse, which, before it brought them into conflict with man, was useful in some way to the species; and this seems to be true of the migrations of certain prolific species of locusts and grasshoppers, which, inhabiting sandy deserts, often overflow the limits of their natural home, and invade more fertile regions where they are not usually found. While there is no reason to suppose these movements are undertaken through deliberate intention to find new feeding grounds, lack of food is no doubt the chief factor in the development of the migratory instinct of rodents as well as locusts, which latter resemble birds in ability to make long journeys on the wing without rest. The African locust has been met at sea in great clouds more than twelve hundred miles from land, and this species sometimes wanders from its home in Africa to England.

While the movements of rodents and locusts show that the search for food has much to do with migration, they lack the features which make the migrations of birds so remarkable. They occur at irregular intervals, while the movements of birds are almost as regular as the almanac, for, while sea birds seem much exposed to storms,

the days of their arrival and departure can be predicted as if they were satellites revolving round the earth. "Foul weather or fair, heat or cold, the puffins make their appearance at the proper day as promptly as if they were moved by clockwork." While the course of the migration of rodents and locusts is determined by conditions so complicated and irregular that they may be called accidental, the northward journey of birds is often directed to a definite spot thousands of miles away from the starting point, and the resemblance between irregular migration in search of food and the migration of birds is too imperfect to tell us much about the origin of the latter, which resembles more the movements of fishes like the shad, which at a definite season enters upon a journey along a definite path to a spot hundreds of miles away, to return again after the purpose of the journey is accomplished.

Since the number of shad which enter a river in the spring is out of all proportion to its resources as a feeding ground, we might say of them, as we are disposed to say of birds, that they leave their birthplace in search of food; but as they find so little food in the rivers that it may be said, with almost literal exactness, that they make their journey fasting, it is quite plain that this is the wrong point of view; that we must believe they enter the river to lay their eggs, and that we must see in this, and not in the return to the ocean, the purpose of the migration.

As the shad is a marine fish which does its eating at sea, and as its visits to fresh water are only for the purpose of reproduction, the numbers which make their way up the rivers are out of all proportion to the capacity of the streams for supplying them with food. The shad enters the mouths of our rivers in the spring in great schools, and travels up them to a most surprising distance; for the total length of the journey from the sea to the spawning ground and back again often exceeds a thousand miles, and this journey is made almost or quite without food. Many of them, and among these the largest fishes, go on until they meet some insurmountable obstacle, such as a waterfall or a dam, or until they reach the head waters of the river. Before dams were built in the Susquehanna, many shad which entered the Chesapeake Bay at the Capes continued their long-fasting journey across Virginia, Maryland, and Pennsylvania into the State of New York, and traveled through more than five hundred miles of inland waters on the journey upward.

Fragments of Indian pottery, stamped with a pattern made by the impression of a shad's backbone, have been found in southern New York, and the number of stone net-sinkers which have been picked up in the Wyoming Valley shows that the Indians had known

and used these fisheries long before the first white settlers found them at work with their rude seines. In the early part of this century, before canals and the dams which supply them were made, there were forty fishing stations beyond the forks of the Susquehanna in northern Pennsylvania, and some of them were worth from one thousand to twelve hundred dollars a year to their owners. There is a record of the capture, at a single haul, of ten thousand shad at one of these fisheries on Fire Island, near Wilkesbarre. Dams across the river have excluded the shad from more than two hundred miles of the course of the Susquehanna, and the profitable fisheries now reach for only a few miles above the boundaries of Maryland, while the shad are cut off from many of the best breeding grounds, which are the sandy flats near the shores of streams and the sand bars which lie in their course. The fishes run up into these places in pairs in the early evening after sunset, and the eggs are thrown into the water while the fishes are swimming about, but they soon sink to the bottom and develop very rapidly. The number of eggs is about twenty-five thousand, but a hundred thousand have been obtained from a single large shad. Few adult shad escape all the dangers of their journey, and these few are so battered and emaciated that they have no value as food, and are unknown in our markets, which are supplied with those that are captured on their way upward. The young fish remain in the rivers until late in the fall, feeding upon small crustacea, the larvæ of insects, the young of other fishes, and minute active animals, and they grow to a length of two or three inches by November, when they leave our waters for the ocean. The shad is a marine fish which has acquired the habit of laying its eggs in fresh water, out of reach of the innumerable enemies that abound on the shoals and sand bars of the seashore. Since the eggs are abandoned by their parents soon after they are laid, prolonged residence at the breeding grounds is not necessary, and the shad has thus been able to utilize safe places which supply no proper food and are unfit for prolonged residence. If it were compelled to incubate its eggs and to guard and protect and feed its nestlings like a bird, it would have been restricted to some breeding place fitted for more prolonged residence, and we should then feel something of the same tendency to call its birthplace its true home that we experience in our study of birds. We should refer the migration to this place as the starting point, and we should try to discover some reason why they spend part of the year elsewhere.

Most animals owe their existence to the occurrence, in their natural home, of all that their life requires, but the power to traverse great distances at great speed, and to pass over all the barriers of land and water, joined to their comparative indifference to changes

of temperature, permits birds to divide their time between widely separated regions, and, whether the choice be conscious or unconscious, the breeding places of migratory birds are selected on account of their safety, and not because they furnish all that a permanent home must supply. If we believe, with Professor Marsh, that the power of flight was acquired by birds after they became arboreal, we must look for the primitive home of the migratory birds in the great tropical and subtropical forests where arboreal reptiles and arboreal mammals still abound; nor can we believe the great armies of northern birds which find abundant food in southern lands in winter are driven out by scarcity on the approach of spring. Enemies are numerous in the tropics, but no animals have sharper senses or better means of escape than birds, and, trusting in their power of flight and their quick sight and hearing, they venture into danger with confidence. The great charm of birds to us is the fearlessness with which they approach man, who is the most dreaded enemy of all other vertebrates; but while adult birds are eminently fitted for taking care of themselves, the opposite is true, in even greater degree, of nestlings, for no animals are at the same time more helpless and more exposed to danger than many young birds, while eggs are not only absolutely helpless but also very tempting to enemies, although there is no group of animals in which the safety of the eggs and young is more important. Among birds a high birth rate is incompatible with flight, for their eggs are large and heavy, and the preservation of each species imperatively demands that every egg shall be cared for with unceasing solicitude; for while, in other animals, increased danger to eggs and young may be met by an increase in the birth rate, this can not be much increased in birds without corresponding loss in the power of flight. Every one knows how quickly birds are exterminated by the destruction of their eggs and young, and the low birth rate of all birds of powerful flight is a sufficient reason for migration, for at the same time that flight limits the birth rate it permits the birds to seek nesting places beyond the reach of their enemies; and as there is rigorous selection of the nestlings which are born in safe nests, it is easy to understand how the instinct has been gradually fixed by selection, and how, as it has become more and more firmly fixed, and as the safety of the eggs and young has become assured by the remoteness and isolation of the nests, the birth rate has been still more reduced and the power of flight correspondingly extended. Many sea birds that nest on desolate rocks in midocean lay only one egg each year, and have the power of flight in its highest perfection. The power of the storm petrel to wander is as boundless as the ocean, and while it lays only a single egg, it is said to be the most prolific

of birds, since the number of individuals is greater than in any other genus.

We can not believe that all migratory birds inherit the habit from a common parent which was migratory, nor is it probable that in all cases it owes its origin to the same influences; but if the view which is here advanced be correct, we must believe that in most migratory birds it has been brought into existence by the needs which are involved in reproduction, and not by the supply of food, and that the winter home of birds in tropical and temperate regions, and not the birthplace of modern birds, must be regarded as the starting point for the migratory habit.

While Wallace was the first to recognize the importance of selection in the formation of this and other instincts, he seems to think selection alone, without the influence of geological change, is inadequate to explain all the facts of migration. He says: "It appears to me probable that here, as in so many other cases, 'survival of the fittest' will be found to have had a powerful influence. Let us suppose that in any species of migratory birds breeding can, as a rule, be only safely accomplished in a given area; and, further, that during the great part of the rest of the year sufficient food can not be obtained in that area. It will follow that those birds which do not leave the breeding area at the proper season will suffer, and ultimately become extinct, which will also be the fate of those which do not leave the feeding area at the proper time. Now, if we suppose that the two areas were for some remote ancestor of the existing species coincident, but by geological or climatic changes gradually diverged from each other, we can easily understand how the habit of incipient and partial migration at the proper seasons would at last become hereditary, and so fixed as to become what we term an instinct. It will probably be found that every gradation still exists in various parts of the world, from a complete coincidence to a complete separation of the breeding and the subsistence areas; and when the natural history of a sufficient number of species is thoroughly worked out, we may find every link between species which never have a restricted area where they breed and live the whole year round to others in which the two areas are absolutely separated."

Modern zoölogy owes its scientific basis to the work of Wallace and Darwin on the distribution of birds, which, in their hands, has led to a revolution in our conceptions of Nature, and has given so much weight to their opinions that no one would venture to differ from them inconsiderately, although when we try to interpret, in the light of his other writings, Wallace's assertion that "the habit of incipient and partial migration" may "at last become hereditary," we must doubt whether he has carefully weighed his words.

We must also remember that distribution and migration are distinct phenomena, and that while the geographical distribution of birds shows clear indications of the effect of past geological changes in the distribution of land and water, migratory birds are kept, like other birds, from invading other provinces than their own by competitors and enemies rather than by geographical barriers.

As so many birds move toward the poles of the earth to lay their eggs, and toward the equator to spend the winter, the view that their two homes have been drawn apart by changes of climate seems probable at first sight, but the rule is not universal, for many of the great breeding grounds of sea birds are in temperate or tropical regions. The petrels, albatrosses, terns, gulls, and many other birds pass most of their life scattered over the ocean, but this affords no nesting place, while the wastes of water which keep carnivorous mammals and reptiles and other enemies of nestling birds from the remote and desolate rocks and sand bars of the open ocean are no obstacle to them. These spots are so secure that birds born in them are much more likely to survive than those born on the shores of inhabited lands, so that it has come about that all or nearly all of the modern members of these groups are descended from ancestors which shunned the dangerous nesting places, not because acquired habits have become hereditary, nor because their feeding ground and their nesting place have been drawn apart by geological change, but because all which did not instinctively lay in safe places the few eggs which are all their fitness for continuous and rapid flight permits, have been exterminated. These birds now gather from all parts of the ocean on the few widely scattered rocks and islands where their young are safe, and the periodic assemblies of innumerable multitudes of wandering sea birds in the "rookeries" are true migrations, for they are as regular as the almanac in the time of arrival and departure, although their feeding ground is almost as extensive as the ocean and the food supply has nothing to do with their movements, and although they do not reach the "rookeries" by a single path.

In this case the needs of reproduction are the controlling influence, and the site of the "rookery" has been fixed by its safety; and while it is difficult to say how far the birds are guided by knowledge of the danger of other places, the well-known tameness of sea birds in their breeding places, and their apparent ignorance of the existence of enemies seem to show that they are quite unconscious of the advantages of the chosen spot, and that they resort to it automatically or naturally not because they know its safety, but because they owe their survival and existence to the fact that it is safe.

Zoölogists are far too ready to resort to the boundless fields for

speculation which geology affords, and it has been gravely suggested that the migration of the lemmings and their death in the waters of the ocean may be due to their efforts to reach the lost Atlantis, where their ancestors dwelt during the Miocene period, although this opinion has no better basis than the belief of Olaus Magnus that they rain down from the sky, where they are engendered from the decomposing exhalations from the clouds impregnated by the semen of rats.

It is easy to understand how birds near the northern limit of their range invade the territory of those whose home is a little farther south, and compete with them for food as this becomes scarce with the approach of winter, and how this movement spreads until all the members of the species are involved, although many of them might have been able to subsist some time longer in their breeding ground if they had been undisturbed.

We have seen that this has commended itself to northern naturalists as a sufficient reason for the acquisition of the migratory habit, and the fondness for their birthplace which is so strongly marked in birds has been thought enough to draw them back; but love of home is itself a result of natural selection, and the necessity for finding safe places for the eggs and young is enough to account for the migration without the aid of geological changes.

While we know little as to the means by which birds find their way over land and water, we know that, as a matter of fact, they are able to do so; and we also know that the instinct which leads them to seek safe places for their nests is so firmly implanted in their nature that centuries of domestication weaken it but little, for it is still almost as strong in the Guinea fowl and the turkey and the hen as it is in wild birds. As birds of powerful flight have a range of choice almost as wide as the earth itself, it is not surprising that the continual destruction of those born in the least safe nests has at last resulted in the survival of the ones which make their nests thousands of miles away from their natural or ancestral home.

While most writers have thought migration had its origin in an annual journey which, while short, was definitely fixed for all the members of the species, and while they have felt forced to call in the aid of geology to account for the gradual separation of the two termini and the lengthening of the journey, the hypothesis of geological change seems gratuitous and unnecessary, since the known habits and instincts and needs of the birds are in themselves a sufficient explanation of all the broader and more general characteristics of migration. It seems much more simple, and more consistent with our knowledge of the past history of living things in general, to believe it had its origin in an intense but geographically

indefinite impulse which led birds to scatter at the breeding season and to hunt out safe hiding places for their nests; and that, as enemies also improved in power to find the most accessible nests, the instinct has been gradually shaped into definiteness by extermination and natural selection, until at last safe breeding grounds, far away from home and far out of the reach of natural enemies, have become established, and until many species and all the members of each species have come to share the impulse to resort to the selected breeding places on the approach of sexual excitement, and to follow the same path between distant points; that the increasing safety of the eggs and young has permitted a low birth rate and the improvement by selection of the power of rapid and long-continued flight; and that this has in its turn permitted the migration to become longer and longer, and more and more protection to the eggs and young.

The history of migratory birds has been long and complicated, and there has been time for great changes in climate and in the distribution of land and water, and these have no doubt left some permanent impression on the habits of birds. The birds have not eluded all their enemies, for predaceous birds and their prey are found together at both ends of the journey. New ways to escape enemies and new ways to find food are as important as they ever were, and the details of the subject are very complicated, although it seems clear that its broader outlines admit of explanation without recourse to geological changes or the inheritance of the direct effects of the conditions of life.

In conclusion, I wish to remind the reader that our present interest in migration lies in its value and simplicity as an illustration of the general law that the adaptations of Nature are for the good of the species and not for the benefit of the individual.

This law is universal, but since the welfare of the species is usually identical with that of the constituent individuals, it is not obvious unless the good of the species demands the sacrifice of individuals.

Long journeys are hazardous. Every California salmon which enters on the long journey to the breeding ground is destroyed, and the whole race of adult fishes is wiped out of existence, for the good of generations yet unborn. Few shad ever return to the ocean, and storm and accident and ruthless enemies work their will on the migrating birds and decimate them without mercy, although the dangerous return to the safe breeding grounds still keeps up, in order that children which are yet unborn may survive to produce children in their turn.

The safeguards which Nature throws around eggs and infants and the immature, and the indifference to the fate of the mature ani-

mals which is exhibited by the influences that have modified species into fitness for their environment, are facts which must never be lost sight of, for if we forget them our attempts to understand the history of the properties of living things are certain to mislead us and to end in failure.

PRINCIPLES OF TAXATION.

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XVII.—THE CASE OF KIRTLAND *vs.* HOTCHKISS.

THE above designation has been popularly given to one of the most important questions that has ever come before the legal tribunals of this country, and the record of which has been heretofore so difficult of access that it has not attracted the attention it merits, but which it is to be hoped will prove at no distant period a subject of popular interest and future judicial consideration.

The particulars of the case are in the main as follows:

In 1869, or previous, Charles W. Kirtland, a citizen of Woodbury, Litchfield County, Connecticut, loaned money, through an agent, a resident and citizen of Illinois, on bonds secured by deeds of trust on real estate in the city of Chicago. Each of these bonds declared that "it was made under and is in all respects to be construed by the laws of the State of Illinois," and that the principal and interest of the obligation were payable in the city of Chicago. The deed of trust also contained a provision that all taxes and assessments on the property conveyed should be paid by the obligor (borrower) without abatement on account of the mortgage lien; that the property might be sold at auction, in Chicago, by the trustee, in case of any default of payment, and that a good title, free from any right of redemption, on the part of the obligor, might in that case be given by the trustee. Another interesting feature of the case not to be overlooked was, that pending the proceedings to be next related, the loans as originally made became due and were paid; when the proceeds, without being removed from Illinois and returned to Mr. Kirtland in Connecticut, were reinvested in Chicago by his agent, under terms and conditions as before.

These facts becoming known to the tax officials of the town of Woodbury, they added in 1869 to the list of property returned by Kirtland for the purpose of taxation, as situated within the State, the sum of eighteen thousand dollars; and in 1870 the sum of twenty thousand dollars, to represent the amount of property owned and

loaned by Kirtland, in each of these years, as was conceded, without the territory of the State. The sums thus added were subsequently assessed in the town of Woodbury in the same manner and at the same rate as was other property which Mr. Kirtland owned within the State and there situated.

Payment of the taxes thus assessed on the amount of these Illinois loans being refused by Kirtland, the tax collector (Hotchkiss), in April, 1873, levied his tax warrants on the real estate of the alleged delinquent in Woodbury, and advertised the same for sale; and on petition for injunction to restrain the collector from such proceedings, on the ground of the illegality of the tax in question and its assessment, the case came before the court of last appeal in the State, known as the "Supreme Court of Errors"; it being agreed by all parties concerned that the only question in the case was whether the bonds owned by Kirtland, drawn in the form and manner stated, were liable to taxation in Connecticut.

CASE FOR THE RESPONDENT.—In the argument before and in the opinion rendered by this court the following were the points mainly relied upon in support of the position that the petition for injunction in restraint of the collection of the tax should not be granted: *First*, that the statutes of Connecticut explicitly authorized and required the taxation of debts due its citizens from parties out of the State. *Second*, in respect to the power of the Legislature of Connecticut to authorize and require such form of taxation, it was claimed that there was no provision in the Constitution of the State limiting and defining such power of taxation. *Third*, the following characterization of the nature of a debt or a chose in action, and its suitability as a subject for taxation for the purpose of obtaining revenue, was put forward by the counsel for the State as a statement of economic conclusions worthy of full acceptance. "It (a chose in action) has not a visible, tangible form. The note, bond, or account even, may be evidence of a debt, but it is not the debt itself. The specific money when loaned, and received by the borrower, is no longer the property of the creditor. It is soon merged in the circulating mass, and the creditor can neither identify and claim it, nor put his hand upon any property purchased with it, and say that that is his. The money may be invested in real estate, or manufacturing, or merchandising, or speculation. It may prove a profitable investment, or it may in a short time prove a total loss. It is all the same to the creditor so long as his debtor's ability to pay is unimpaired. He has simply a right to receive a given sum of money with interest or damages for its detention. It is a personal right, and accompanies the person of the creditor. The debtor is under a corresponding obligation to pay the demand. The right to receive is

valuable, and through it an income is derived. *That right may with propriety be taxed.* The obligation to pay is a burden, and has never, to our knowledge, been the subject of taxation. It seems, therefore, that the appropriate place to tax money at interest is where the creditor resides, and that for that purpose it may with propriety be said to be located with the creditor." *

The respondent attached much importance to the analogy "between a money demand, evidenced by a note or bond, and shares of stock in a corporation"; and to the fact that the United States Supreme Court had decided that shares of stock in national banks are property, separate and distinct from the property of the corporations which they represent, and are taxable" (*National Bank vs. Commonwealth*, 9 Wall., 353).

Reference was also made to the case of *Minot vs. The Philadelphia, Wilmington & Baltimore Railroad Company*, in which the United States Supreme Court was held to have recognized a distinction between shares of railroad stock and the capital (property) of a corporation, and in respect to which it was assumed that the court maintained that the share of a stockholder is something different from the capital stock of a company; the latter being the property of the company only, while the former is the individual interest of the stockholder, constituting his right to a proportional part of the dividends when declared and to a proportional part of the effects of the corporation when dissolved after payment of its debts. Regarded in that aspect, it was held to be an interest or right which accompanies the person of the owner and having no locality independent of its domicile.

But whether, when thus regarded, it can be treated as so far separable from the property to which it relates as to be taxable independent of the locality of the latter, was a question which the counsel of the State did not hold to be decided; but there was a strong intimation that the United States Court intended to decide that shares of railroad stock can only be taxed in the State where the owner resides.

CASE FOR THE PETITIONERS.—On the other hand, the following is a summary of the arguments and reasons advanced (mainly by one of the most learned and distinguished members of the Court of Errors of the State, and of the American Bar, Hon. L. F. S. Foster, formerly president of the United States Senate and acting Vice-President of the United States), in support of the petition for an injunction in restraint of the collection of a tax upon the plaintiff:

* Reference in this connection is made to the opinions on this general subject expressed by the Supreme Court of California, given in chapter xvi, *Popular Science Monthly*, pp. 651-653.

"Taxation and protection are correlative terms. Protection to the person is the ground on which the right to tax the person rests. Protection to the business, protection to that portion of the property not taken by the tax, is the consideration or compensation for all legitimate taxation on business or on property. The person must be domiciled within the State to be subject to a personal or poll tax; the business or the property must also be within the territory of the State to confer jurisdiction over them. That the person of the plaintiff is within the jurisdiction, and subject therefore to the taxing power, is apparent from the record. This tax, however, is not imposed on the person; it is imposed on the property of the plaintiff, and as such it must be sustained, if sustained at all. The case does not require any description of the various species of property, real, personal, etc. Real property has, of course, an immovable *situs*, and can never be subject to any taxation except that imposed by the government within whose jurisdiction it is situate. The reason is, that that government is the only one that can afford it protection. Personal property, of whatever it may consist, though capable of being transported from place to place, if it be of a visible and tangible kind, would seem, in the nature of things, to follow the same rule and for the same reason—that is, to be subject to taxation by the State within whose jurisdiction it is situate, as that State only has dominion over it, and as that State only can afford it protection.

"Now, if the property in question be considered real property, it being in the State of Illinois, any tax upon it by Connecticut would be extraterritorial and void. If it be considered personal property, of a visible and tangible character, it is still in the State of Illinois, and so just as much out of the dominion and beyond the jurisdiction of the State of Connecticut as though it were real property. If we consider the property to be an interest in real or personal property, or a title, inchoate, equitable, or legal, to such property in Illinois, such interest, or such title, is no legitimate subject of taxation in Connecticut. The *corpus* and *situs* of this property being in Illinois, and subject, of course, to taxation there because within her jurisdiction, no interest in it, no title to it, can be taxable in Connecticut. Such a claim involves one of two absurdities: either that the same property may be in two places at the same time, or that two independent governments can have jurisdiction over the same subject-matter at one and the same time.

"But the property of the plaintiff on which this tax has been imposed is not real property, nor is it personal, of the character here considered. It may be well to describe it precisely, that there may be no room for misunderstanding.

"The plaintiff loaned money in the city of Chicago, in the State

of Illinois, on bonds conditioned for its repayment, and secured by deeds of trust. One of said bonds, and one of said deeds, as a specimen of all, is made part of the record. This bond declares 'that it is made under, and is in all respects to be construed, by the laws of the State of Illinois, and is given for an actual loan of money [\$3,000] made at Chicago, by Charles W. Kirtland [the plaintiff], to Edmund A. Cummings [the obligor] on the day of the date hereof' [July 17, 1869]. The deed of the same date is a conveyance in fee, by Cummings and his wife, of a lot of land in Chicago, to Norman C. Perkins, of said city, to be held by him in trust, as security for the payment of said loan, with power to sell and convey the same, and apply the proceeds in payment of the loan, in case of default on the part of said Cummings to perform the stipulations of said bond. It is quite obvious that Cummings has incurred a debt to Kirtland, and that Kirtland has a claim against Cummings. Cummings is the debtor, Kirtland the creditor. Has this debt a *situs*? If it has, where is it? In Illinois, or in Connecticut? The contract to loan was made in Illinois, there the creditor parted with his money, there is the property pledged for its repayment, there the debtor is domiciled, there the trustee.

"This seems to indicate Illinois as the *situs* of this debt. So far as it is a thing having a substantial existence, it is there, and not elsewhere. The Connecticut statute provides in terms, 'that money secured by mortgages upon real estate in this State shall be set in the list and taxed only in the town where said real estate is situated.' This manifestly recognizes the *situs* of the property pledged as security for a debt, as the *situs* of the debt. But a debt has no *situs*. Only a material thing can have a *corpus*, and only a *corpus* can have a *situs*, for it is the location of the *corpus* that constitutes a *situs*. A debt is neither visible, tangible, nor ponderable; it has no *situs*, no *corpus*. It is a misnomer to call it property. In legal phrase it is but a *chose in action*, a *jus incorporale*. It is an equitable title in the property of the debtor, and it adheres, as a title, in the property it represents. It does not follow the person of the owner in his domicile, though he may transfer it there.

"These views are fully sustained by the United States Supreme Court, in the case of *Brown vs. Kennedy*, 15 Wall., 591.*

* In this case, which covered a proceeding under the confiscation act of 1862, the United States Court rejected the theory that a credit has a legal *situs* where the owner resides, and held that a bond and mortgage form of credit could be confiscated by the United States where the mortgage debtor resided, though, in point of fact, the bond and mortgage were never in the State of Kansas where the proceedings in forfeiture took place, and were, in fact, in possession of the owner, in the rebel lines, in the State of Virginia. The court accordingly passed a decree, and ordered that the said bond, mortgage, and credit be condemned and declared forfeited to the United States. The decree also ordered

"The same court also held to similar conclusions in a number of other cases. Thus, in the case of *Pelham vs. Rose*, 9 Wall., 103, a note, the evidence of the credit, not the credit itself, was the thing proceeded against. In the case of *Pelham vs. Way*, 15 Wall., 196, where the court also held that the proceedings, not having been against either the debt or credit, but only against the material evidence of it, and that material evidence having been out of the marshal's jurisdiction, no confiscation had been effected.

"Now, if these decisions," said Judge Foster to his colleagues in the Court of Errors, "are to be recognized as law, how can it be claimed that on this credit, given by Kirtland to Cummings in the State of Illinois, secured by a deed of real estate there situate, held by a trustee resident there, the debtor being domiciled there, the debt made payable there, the laws of Illinois by express agreement to govern the contract; how (for the question bears repeating) can it be claimed that there is any subject-matter within the jurisdiction of Connecticut on which to impose a tax?

"That the land in Illinois which is the security for this debt, and of which this debt is the representative, has borne its full share of taxes without diminution on account of this debt is not denied. If the land were in Connecticut, this would suffice; no tax could be collected on the debt. That the land is in Illinois can not affect the principle. If each State has dominion over the property, real and personal, within its territory for the purposes of taxation—and he must be a bold man who denies it—that dominion must, from its nature, be exclusive. No other State can have concurrent jurisdiction. Nor does any other State become invested with the power to tax, if the State in which the power is vested omits to exercise that power. Should a State exempt the property, real or personal, within its limits, belonging to non-residents, from taxation, by what authority could any foreign State impose taxes on such property? The question is purely jurisdictional, and the matter of double taxation is not involved. The point is not whether the State may tax a thing

Kennedy, one of the obligors and mortgagors, to pay the debt into the court, for the use of the United States; and in pursuance of the decree the payment was made to the officers of the court. After the termination of the war, or in 1868, Brown, the obligee and mortgagee in this bond and mortgage, having obtained a pardon from the President of the United States, filed a bill in the United States Circuit Court for the district of Kansas against Kennedy and wife, for the foreclosure of this mortgage. The principal defense was, that the mortgage and the debt secured by it had been confiscated under the act of Congress. That, of course, put in issue the validity of those proceedings. It was admitted as matter of fact and agreed, that Brown, the complainant, was and always had been a resident of Virginia, had been a continuous resident of the State from June, 1860, to September, 1865, and neither the bond nor mortgage in question was during any part of that time in the district of Kansas.

twice, but whether there is anything within its jurisdiction that it can tax at all.

“Resort must be had to a legal fiction to draw this debt into Connecticut. It does not appear from the record that even the evidences of the debt, the bond and deed, were held in Connecticut.”

Under such circumstances, it is curious to note, as Judge Foster especially pointed out, to what a singular and absurd hypothesis and procedure the Connecticut authorities, as if conscious that they had abandoned reason and were dealing with sentiment, had recourse in order to get a basis and a warrant for their action. They first assumed that there was an imaginary property, separate and distinct from the material property; and then gave to such imaginary property an imaginary *situs*, thus “going far into the domain of the sentimental and spiritual for the purpose of taxation.” Bishop Berkeley, it will be remembered, held to the opinion that matter does not exist, and that we only imagine that it exists; but it is not at all probable that he ever hoped, when alive, that his views would be so practically indorsed, and at so early a day, in the State of his literary adoption. He would have made, moreover, a desirable tax assessor and tax collector under the present Connecticut tax laws; for being logical, even if he was sentimental, he would doubtless have been willing to take the taxes in the pure product of the imagination. His successors, however, were not only sentimental but illogical; for, not content with assuming that the imaginary is the real, they tried to do what the good bishop never would have sanctioned—namely, take something out of nothing.

But apart from these curious and novel politico-economic and legal features, this Kirtland case involves constitutional questions of the highest interest and importance—as much so, perhaps, as any case ever brought to judicial arbitrament since the formation of the Federal Constitution.

The power of the State to tax the business of loaning money, like the power to tax any business transacted within its limits, by way of license or otherwise, whether the money be loaned to parties within or without the State, is unquestionable.

But this, however, can not be exercised by a State when the business is done without the State, though it be done by citizens of the State. Citizens of Connecticut transacting business in Illinois must, therefore, be subject to the laws of Illinois, and not to the laws of Connecticut. Again, if each State of the Federal Union has dominion over the property and business transacted within its territory for the purpose of taxation, that dominion must from its very nature be absolute and exclude the dominion of any other State over the same property and business. Again, the sovereignty of coequal

States involves a full recognition of the dominion and sovereignty of all sister States; and hence section one, Article IV, of the Federal Constitution requires that "full faith and credit shall be given to the public acts, records, and judicial proceedings of other States." Each State, then, in entering the Federal Union, entered into a contract of non-interference with the dominion and prerogatives of other States; and it will not be disputed that the power of taxation is an incident of sovereignty or dominion. The dominion, therefore, of one State for the purpose of taxation over persons, property, business, or the incidents of business, must exclude the dominion of other States over the same persons, property, business, and incidents of business at the same time. Neither in constitutional law in the United States nor in mathematics can the same property, persons, business, or incidents of business occupy two places and two sovereignties at the same time. Hence, the taxation by Connecticut of credits, choses in action, bonds, notes, book accounts, verbal and other contracts, the incidents of actual business transacted in Illinois, must be in legal effect extraterritorial taxation of such business, and so an infringement and violation of the sovereignty of Illinois; or else it must be assumed that business does not include its incidents, or the whole its parts.

Furthermore, if Connecticut has the power of taxing extraterritorial contracts for the loan of money, she has the power to fix any rate and to discriminate as to the States upon whose citizens the burden shall fall; or she may adopt a rate that shall be prohibitory on contracts made by her citizens with citizens of designated States, or citizens of all the States, as her caprice may dictate.

And in this way she may obstruct and to a great extent prevent interstate commerce, which the United States Supreme Court in repeated instances (since the Kirtland case) has decided that the separate State governments can not under the Federal Constitution do either directly or indirectly.

From these considerations, reasoning, and precedents the conclusions of Judge Foster would seem to have been incontrovertible—namely, that "the plaintiff," Kirtland, "was not liable to taxation" in Connecticut "for debts owing to him in Illinois"; and inferentially that, although possibly warranted by the letter of the statute, the act was an attempt on the part of Connecticut to exercise extraterritorial dominion over persons, contracts, or business, and was, therefore, unconstitutional and void. It would also seem to be clear that if property in action (choses in action) is made by fiction of law an *entily*, having a *situs* in one State separate from the property which it represents in another State, an opportunity for the grossest inconsistencies will be perpetrated, and the most

inharmonious, arbitrary, and capricious tax laws and other laws will be enforced by conflicting legislation of States, required by constitutional obligations to "give full faith and credit to the public acts of other States."

The Connecticut Court of Errors, however, dissolved the injunction and dismissed the petition, Judge Foster alone out of a full bench of five dissenting. An appeal being next taken to the United States Supreme Court, the latter (in 1879) affirmed the judgment of the Connecticut court, the essential points of the opinion rendered by Mr. Justice Harlan being as follows: "The debt which the plaintiff, a citizen of Connecticut, holds against the resident of Illinois is property in his hands. The debt, then, having its *situs* at the creditor's residence, and constituting a portion of his estate there, both he and the debt are, for purposes of taxation, within the jurisdiction of the State. It is, consequently, for the State to determine, consistently with its own fundamental law, whether such property owned by one of its residents shall contribute, by way of taxation, to maintain its government, and 'its discretion in that regard is beyond the power of the Federal Government to supervise or control, for the reason that such taxation violates no provision of the Federal Constitution'; as manifestly it does not, as supposed by counsel, interfere in any true sense with the exercise by Congress of the power to regulate commerce among the several States; nor does it, as is further supposed, abridge the privileges or immunities of citizens of the United States, or deprive the citizen of property without due process of law, or violate the constitutional guaranty that the citizens of each State shall be entitled to all the privileges of citizens in the several States.

"Whether the State of Connecticut shall measure the contribution which persons resident within its jurisdiction shall make by way of taxes in return for the protection it affords them, by the value of the credits, choses in action, bonds or stocks which they may own (other than such as are exempted or protected from taxation under the Constitution and laws of the United States) is a matter which concerns only the people of that State, and with which the Federal Government can not rightfully interfere."

It remains but to indicate the legitimate deductions and consequences of this decision, and point out some of the circumstances pertinent to the treatment of the case when it was before the United States Court.

In the *first* place, it decided that debts are property; a legitimate deduction from which is that the creation of debts creates property, and the extinguishment or payment of debts annihilates property; a conclusion which has not received the sanction of the judiciary, or

found a place in the tax system of any country other than the United States. *Second*, the decision next gave a miraculous power to residence, by making it capable of producing property out of nothing. *Third*, it sanctioned the right of a State to subject its citizens to double taxation in respect to one and the same property, and indorsed the justice and morality of the act. If the *situs* of the property—in the sense of an actuality—and the owner of a mortgage upon it, are within the territory of one and the same State, and the actuality is fully taxed by it, the separate and duplicate taxation of the mortgage would not be sanctioned except at the demand of the debtor, and which, as equivalent to his asking that the burden of his debt be augmented, he would be not likely to make. But when the actuality and the mortgage are in different States of one and the same nation, as was the situation in the Kirtland case, a different rule is held to prevail, whereby that which in one State was regarded as an incident of property, and as such properly exempt from taxation, becomes by mere transference to another State actual property, and so rightfully subject to taxation.

Fourth. If debts are property, and rightful subjects for taxation, the sphere of the application of this principle should not be restricted to debts created by a mortgage, but should embrace every form of indebtedness created by the loan of capital—as promissory notes, book credits, and policies of life insurance—which are valuable to just the extent that they represent the indebtedness of the company issuing them to the holder of the policy. But if all the forty-four States of the Federal Union or the different countries of the rest of the world were to undertake to pursue capital in the form of debts due their respective citizens for the purpose of taxation, the resulting inextricable and disastrous confusion would be almost beyond the power of imagination.

Fifth. The United States Supreme Court held that there was nothing in the form of taxation involved in this case that interfered with the power of the Federal Government to regulate interstate commerce; but if, as was further held, there was no constitutional limitation on the exercise of the power of taxation by the State of Connecticut, and that the Federal Government can not rightfully interfere with the measure of taxes that a State may impose on credits and choses in action that its citizens may own, it is difficult to see why Connecticut might not impose such taxes on all extraterritorial contracts of pecuniary value as would greatly impair or altogether prevent the commercial intercourse of her citizens with the citizens of other States. Finally, nothing more clearly exhibits the anomalous issues involved in this case than the fact that it could not have come up before any of the courts of England, France, Bel-

gium, Germany, Switzerland, Italy, or Lower Canada; for in none of these countries are debts regarded in the light of property, subject to taxation.

The following facts pertinent to the history of this case are also worthy of record: When the appeal from the decision of the Connecticut Court of Errors was made to the United States Supreme Court, one of the most distinguished members of the bar of the State of New York, and who in repeated instances had commanded the respect and attention of the former court, was moved, through his abstract interest in the legal and economic principles involved in the case, to volunteer his services for its future argument and presentation to this high and final tribunal. But on the day assigned for its hearing, serious illness prevented his attendance on the court, and the case in question went before it practically without verbal argument, and mainly on the presentation of a brief. Some years after the decision was rendered, the then chief justice of the court (the late Morrison R. Waite) told the writer, in a familiar interview, that he had no recollection of the case, and expressed much interest in a presentation of the economic points involved in it.

Another fact especially worthy of the consideration of those who have been instrumental in enacting and defending statutes in respect to taxation in the United States which find no justification in economic principles, or any parallel in the laws or fiscal systems of other countries of high civilization, is, that since the final decision in the Kirtland case, the State of Connecticut, where it originated, has derived no material advantage from it. Nay more, a somewhat extensive inquiry made of its tax officials renders it doubtful if a single extraterritorial mortgage has since been made subject to taxation as property in the form of a debt in the State of Connecticut. And the same is generally believed to be true of a vast number of mortgages of real estate—especially of farming lands of the Western States of the Federal Union—which in recent years have been negotiated and sold by the large number of the so-called “loan and trust companies” in the Eastern States. The fact is, the American people, whose interests have called their attention to this form of taxation, regard it as unequal and unjust, and so clearly in the nature of double taxation on one and the same person and property, and an exaction, that evasion of it is clearly warranted; the whole record of experience under it constituting another demonstration of the fact that under a popular form of government any law regarded as unjust or unnecessary can not be efficiently executed; and to avoid the necessity of evasion it has now become almost the universal practice, in executing mortgages in the United States, that if the mortgage is made subject to taxation the mortgagee shall pay the taxes in addi-

tion to the interest on the loan of capital represented by the mortgage.

NOTE.—In addition to what may be termed the historical elements of this celebrated case, the more strictly legal features of it, as set forth subsequent to the action of the United States Supreme Court, are here pertinent and worthy of consideration:

No. 1. This case seems from its very nature to involve questions of conflict of State dominion. It is admitted that Mr. Kirtland, the plaintiff, so far as the question of taxation at issue is concerned, has not been assessed and taxed upon his body, person, poll, or head, or for any substance, the embodiment of labor, and which alone constitutes property, owned or possessed by him within the territory of Connecticut; nor for any business transacted by him within the State. The plaintiff has, however, been assessed and taxed for dealing in money or doing the business of loaning money, by an assessment and taxation of bonds and mortgages made in Illinois—the necessary incidents and evidence of the business of money lending, performed by himself or through a resident agent in the State of Illinois. It is conceded that the loans were actually made at Chicago in the State of Illinois, as the bonds and mortgages taken state that all the business and acts connected with the loaning and reloaning were actually done, from time to time, there, that the obligations were payable there, and that the contracts of loan were strictly Illinois contracts, to be interpreted as valid or invalid and as to their force and effect according to the laws of that State.

The State of Illinois imposes a tax on resident agents making loans in that State; but it is not important to inquire whether in this instance the business of loaning was done through a resident agent or what that State does actually tax, but what she can constitutionally tax by virtue of her dominion and sovereignty. Illinois can undoubtedly tax, if the tax is not discriminating but uniform on residents and nonresidents, all occupations and also all business transacted within her borders. She can tax money dealers or money lenders by license or otherwise, and she can impose stamp or other taxes and to any degree, in her discretion, on all contracts at the time when made within her jurisdiction. No other State has concurrent jurisdiction over any legitimate subject of taxation within her jurisdiction. Her sovereignty in taxation is absolute except as limited by the national Constitution. But the sovereignty of coequal States involves a full recognition of the dominion and sovereignty of all sister States, and hence section 1, Article IV, of the United States Constitution requires that "full faith and credit shall be given to the public acts, records, and judicial proceedings of other States." This is a compact of noninterference in the dominion of other States in matters of taxation or in reference to other subjects of State dominion. The power of taxation is an incident of sovereignty or of dominion. The dominion, therefore, of one State for the purpose of taxation over persons, property, or business, or the incidents of business, must exclude the dominion of other States over the same persons, property, business, and incidents of business at the same time. Neither in constitutional law in this country nor in mathematics can the same persons, property, business, and incidents of business occupy two places or sovereignties at the same time. The taxation by Connecticut of credits, choses in action, bonds, notes, book accounts, verbal and other contracts, the incidents of actual business transacted in Illinois, must be in legal effect extraterritorial taxation of a part of such business, or otherwise it must be assumed that the incident is not a part of the principal. The making of contracts is of itself a business in the strictest sense, nor can any business exist without the power to make contracts written or verbal. Money can not be loaned unless there is a business of lending money, and for the time being the vocation of a money lender. The amount or duration of a business in a State can have no influence on the question of the jurisdiction of the State over the business or the transaction. A State can tax all sales at auction, including the sales of goods in unbroken packages owned by nonresidents and just brought into the State and sold by nonresidents or by resident agents (*Woodruff vs. Perham*, 8 Wallace 123). In New York mere wandering peddlers are taxable on money invested in business in every town in which they peddle. If actually assessed in more than one town the same year the remedy is to appeal to the assess-

ors (*Hill vs. Crosby*, 26 Howard, par. 413). It would seem that business, occasional, transient, or permanent, transacted in a State by a resident or nonresident, by the force of State sovereignty, may be made subject to a uniform rule of taxation.

Extraterritorial taxation can have no force in American jurisprudence. Protection and taxation are correlative terms. Protection to that portion of property not taken or absorbed by the tax is the consideration or compensation for all legitimate taxation, and extraterritorial taxation is therefore a mere arbitrary "taking of private property without due process of law." When property is not protected by the law of a country or of a State and beyond the process of its courts, there can be no power to tax it (this principle is manifestly as applicable to business as to property—*Rice vs. the United States*, 4 Wheaton 246). In the foreign-held bond case, 15 Wallace 319, the United States Supreme Court said that "property lying beyond the jurisdiction of the State is not a subject upon which her taxing power can be legitimately exercised. Indeed, it would seem that no adjudication should be necessary to establish so obvious a proposition. The power of taxation, however vast in its character and searching in its extent, is necessarily *limited to subjects within the jurisdiction of the State. These subjects are persons, property, and business.*"

These admitted facts and the opinions cited indicate that Connecticut is endeavoring in this case to enforce an extraterritorial tax on extraterritorial business, and a further consideration of the subject might here be dismissed, but a more detailed examination may show more clearly the unconstitutionality of this arbitrary exaction.

EFFECT OF THE FOURTEENTH AMENDMENT OF THE CONSTITUTION OF THE UNITED STATES IN RESPECT TO THE ARBITRARY APPROPRIATION OF PROPERTY BY TAXATION OR OTHERWISE.—Another point preliminary to reform, and in respect to which it is important that there should be a clear understanding on the part of the people, is that there is a broad and philosophical distinction between "taxation" and "arbitrary" taking. It is often assumed that a State, because of its sovereignty, may, through form of law and delegated authority, deal with the persons and property of its subjects as it may see fit; and, repugnant as this assumption is to the principles which are assumed to constitute the foundation of all free government, it is not to be denied that previous to the adoption of the fourteenth amendment of the Constitution of the United States in 1868, it would be difficult to show that restraint existed upon the complete sovereignty of the States of the Federal Union over persons and property within their unquestioned jurisdiction; the right to hold a certain class of their population in slavery, and the right to take private property for public purposes without making any compensation, being illustrative of the exercise of such arbitrary powers in the utmost extreme. But since the decision of the United States Court in the *Kirtland* case, the same court has for the first time given a decided opinion on this subject, unmistakably as follows: "There is no such thing in the theory of our Government—State or national—as unlimited power in any of these branches. The executive, the legislative, and the judicial departments are all of limited and defined powers. There are limitations of power which arise out of the essential nature of all free governments, implied reservations of

individual rights, without which the social compact could not exist, and which are respected by all free governments entitled to the name. *Among these is the limitation of the right of taxation*" (Loan Association vs. Topeka, 20 Wallace, 658).

In connection with this general subject, the opinion expressed by Chief-Justice Marshall is also historically worthy of notice. It had its origin in the case of *Baron vs. The Mayor of Baltimore*, in which the city of Baltimore, in the exercise of its corporate authority over the harbor, etc., so diverted certain streams of water that they made deposits of sand and gravel near the plaintiff's wharf, and thereby prevented the access of vessels to it. A writ of error was taken from the judgment of the Maryland Court of Appeals, refusing damages, to the Supreme Court of the United States, on the ground that this decision was in violation of the fifth amendment to the Constitution of the United States, which prohibits the taking of public property for private use without just compensation; the plaintiff contending further, "that this amendment, being in favor of the liberty of the citizens, ought to be so construed as to restrain the legislative power of a State, as well as that of the United States." The court, however, by Chief-Justice Marshall, held that this amendment of the Constitution "*is intended solely as a limitation on the exercise of power by the Government of the United States, and is not applicable to the legislation of the States*"; which was equivalent to saying, viz., that if the several States choose to arbitrarily take or confiscate the property of any of its citizens, there was no higher sovereignty to restrain them.

At the close of the late civil war, however, when it was deemed desirable by Congress to impose some restrictions on the reconstructed States, so as to prevent the former disloyal element of their population, in the event of the contingency of regaining legislative power, from dealing arbitrarily or unjustly with any class of their fellow-citizens who might happen to be obnoxious, the following clause was made a part of the fourteenth amendment, and through its adoption has become the supreme law of the land: "*Nor shall any State deprive any person of life, liberty, or property without due process of law.*"

Now, the force of this amendment obviously depends upon the meaning of the last clause, "*due process of law*"; and it is also clear that "*due process of law*" does not mean a procedure in conformity with *any* law which a State legislature might enact, or with any provision which the people of a State might put in their Constitution; for if such be the interpretation of this phrase, then this clause of the fourteenth amendment referred to would practically read as follows: "*Nor shall any State deprive any person of life,*

liberty, or property, except in conformity with such laws as it may enact."

The general meaning of the phrase "*due process of law*," and of the synonymous expression "*law of the land*," has, however, been made so often the subject of discussion and legal decision as to be in no sense a matter of doubt. Mr. Webster, in the Dartmouth College case, defined these terms as follows: "By the law of the land is most clearly intended the general law, which hears before it condemns, which proceeds upon inquiry, and renders judgment only after trial. The meaning is that every citizen shall hold his life, liberty, property, and immunities under the protection of the general rules which govern society. Everything which may pass under the form of an enactment is not the law of the land." And in commenting on this definition, Justice Cooley, in his treatise on Constitutional Limitations, uses this language: "This definition of Mr. Webster is apt and suitable as applied to judicial proceedings, which can not be valid unless they proceed upon inquiry, and render judgment only after trial. It is entirely correct, also, in assuming that a legislative enactment is not necessarily the law of the land. The words 'by the law of the land,' as used in the Constitution, do not mean a statute passed for the purpose of working wrong. That construction would render the restriction absolutely nugatory, and turn this part of the Constitution into mere nonsense. Due process of law," therefore, continues Judge Cooley, after reviewing the interpretations of various other authorities, means "such an exertion of the powers of the Government as the settled maxims of law sanction, and under such safeguards for the protection of individual rights as these maxims prescribe."

"The very idea of taxation, the very elements of the terms tax—taxation—implies that it is an imposition or levy upon persons or property in due course or order, treating all alike in the same condition and circumstances. The burden of taxation must be equalized by this mode in order to preserve its character. It is in any view taking private property for public use; and it can not be so taken without an equivalent both as to the Government or the citizens. It is not competent for the Government to convert private property to public use, by way of taxation and without compensation, any more than by any other mode."—*Redfield*.

Now, the exact applicability of the fourteenth amendment in restraining the several States in the exercise of their so-called "taxing powers" would appear to be this:

Taxation implies protection. It is held by every authority to be the equivalent for the protection which the Government affords to the property of its citizens. When, therefore, a State (like Connecti-

cut) taxes property, either directly or indirectly, out of its territory and jurisdiction, which it can not protect, and which its processes can not reach, the act is not taxation, but a mere arbitrary exercise of power; not in accordance with any "process of law," and forbidden by the Constitution of the United States, and as involving a principle under the Constitution. Furthermore, the question of restraining a State from the exercise of such arbitrary powers would seem to be one legally within the right of any citizen aggrieved, in virtue of the fourteenth amendment, to carry from the courts of his own State to the Supreme Court of the United States. As another method by which a citizen of a State aggrieved by the imposition of an *ex-territorial tax* might test the constitutionality of the same, the following is also worthy of consideration:

A citizen of Connecticut, for example, taxed on personal property in Illinois, might obtain a writ of *certiorari* in an Illinois court, and raise the question that, inasmuch as personal property is held in law to follow the person, the property in question was not taxable in Illinois. And after the courts of Illinois had rendered an adverse judgment, as they undoubtedly would, the owner taxed for the same property in Massachusetts could obtain a writ of *certiorari* in the courts of that State, and raise the following questions:

1. Want of jurisdiction in respect to the property on the part of the State of Massachusetts.

2. Violation of the Constitution of the United States in denying full faith and credit to the "public acts (tax laws of Illinois) and judicial proceedings" of a sister State.

It needs no argument to prove that under the provisions of the Constitution of the United States, above referred to, both the laws and judicial proceedings of one State are as valid and as much to be respected in another State as the laws and judicial proceedings of the latter State itself. If the courts of Massachusetts, following precedents in that State, should decide that personal property situated beyond the State follows the person residing in Massachusetts, and so disregards the judicial proceedings and public acts of Illinois, a question under the Constitution of the United States would arise, which would give jurisdiction in the United States Court. And as one and the same thing can not occupy two places at the same time, the Federal court must finally decide in which State is the *situs* of the property for taxation in the case presented. The principle involved in this case would seem to be identical with an attempt on the part of a State to convict a citizen for an offense committed beyond her jurisdiction, in respect to which judgment had already been rendered in a sister State, where the offense had been committed.

As further bearing upon this subject, reference is made to the

following judicial decisions: The Court of Errors of New York, some years ago, decided that private property could not be forcibly taken for a private road, even if compensation was made by the party benefited, because the act was the taking property arbitrarily, and not according to due process of law.

The national bank act acknowledges, and the courts of the United States have so held, that a bank has a *situs* and its shares a *situs* where the bank is located, and not where the stockholders reside. The national bank act, therefore, discards the usual State principle of taxation, that personal property follows the owner.

The principle that *two States can not tax at the same time the same property, and that a State can not tax property and rights to property lying beyond her jurisdiction*, has been also affirmed by the Supreme Court of the United States (December, 1868), in the case of *The Northern Central Railroad vs. Jackson* (7 Wallace, 262). The railroad corporation in question, extending from Baltimore in Maryland to Sunbury in Pennsylvania, was the result of the consolidation of four railroad companies, one incorporated by the State of Maryland and three by the State of Pennsylvania. The latter State imposed a tax of three mills per dollar of the principal of each bond issued by said road, which tax the company, at their office in Baltimore, deducted from the coupons of the bonds of said consolidated road held by Jackson, an alien, resident in Ireland.

The court, by Mr. Justice Nelson, decided adversely to the tax, on the ground that the bonds were issued upon the credit of the line of road, a portion of which was within the jurisdiction of the State of Maryland, and that the security, bound and pledged for the payment of the bonds and of the interest on them, embraced the Maryland portion of the road equally with that portion situated in the State of Pennsylvania, respecting which condition of affairs the court used the following language:

"It is apparent, if the State of Pennsylvania is at liberty to tax these bonds, that to the extent of this Maryland portion of the road she is taxing property and interests beyond her jurisdiction. Again, if Pennsylvania can tax these bonds, upon the same principle Maryland can tax them; this is too apparent to require argument. The consequence of this, if permitted, would be double taxation of the bondholder. The effect of this taxation is readily seen: a tax of three mills per dollar of the principal, at an interest of six per centum, payable semi-annually, is ten per centum per annum of the interest; a tax, therefore, by each State at this rate amounts to an annual reduction from the coupons of twenty per centum; and if this consolidation of the line of road had extended into New York or Ohio,

or into both, the deduction would have been thirty or forty. *If Pennsylvania must tax bonds of this description, she must confine it to bonds issued exclusively by her own corporations.* Our conclusion is that to permit the deduction of the tax from the coupons in question would be giving effect to the acts of the Pennsylvania Legislature upon *property and interests lying beyond her jurisdiction."*

EVOLUTION AND TELEOLOGY.*

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IN the present paper it is not my purpose to discuss the evidence in favor of evolution or the arguments which may be urged against it. This has been done quite thoroughly in our previous meetings at Paris and Brussels. I shall assume evolution as proved, or rather, that it is the only working theory which is competent to meet the demands of modern science. As against the alternative theory of creationism the evidence, I think, all must admit, is overwhelmingly in favor of evolution. I am quite willing to agree with our retiring president, M. le Marquis de Nadaillac, that as yet the theory is not proved by any demonstrative evidence, for the simple reason that, in the very nature of the case, anything approaching an absolute demonstration, at least in our present state of knowledge, is impossible. But, notwithstanding this, even the most skeptical must concede that evolution is a probable theory, and this is all that need here be claimed.

I freely grant that, *a priori*, creationism is quite possible, but is it probable? Science answers "No." As to affording any positive evidence in behalf of the special creation of species, it is absolutely mute, and the negative evidence is of such a character that there are few, if any, serious men of science who are willing to consider it as having any weight whatever. *A priori*, creationism is possible; *a posteriori*, it is so highly improbable as to be practically ruled out of court. Indeed, those who still cling to the theory rely either on negative evidence, which in such questions is never conclusive or satisfactory, or appeal for support of their view to the account of creation given in the book of Genesis. They assume that the Genesiatic narrative is to be interpreted literally, whereas all contemporary biblical scholars of note declare that it is to be understood not literally but allegorically. Nor is there anything new in thus envisag-

* Read before the International Catholic Scientific Congress, Fribourg, Switzerland, August 20, 1897.

ing the scriptural record, for it was, as is well known, the view accepted by some of the most illustrious of the Greek and Latin Fathers. The Alexandrine school was almost a unit in favor of allegorism as against literalism.* All are familiar with the contention of the late Bishop Clifford, who regarded the first thirty-four verses of Genesis as a ritual hymn, and as nothing more than a prelude to what follows. Even some of the most conservative of our modern commentators of Scripture freely admit that the history of creation, as unfolded in Genesis, may be understood in an allegorical as well as in a literal sense. From this is manifest how weak is the argument in favor of creationism which is based solely on the Genesis narrative.

The argument founded on the doctrine of the fathers is of no more weight than that based on Scripture, while that which may be adduced from the teachings of modern biblical research is practically *nil*. Creationism, then, I repeat, is possible, but there is nothing in a reasonable interpretation of Genesis which makes it at all probable, while all the conclusions of contemporary science render it not only in the highest degree improbable, but also exhibit it as completely discredited and as unworthy of the slightest consideration as a working hypothesis to guide the investigator in the study of Nature and Nature's laws.

But this *en passant*. My theme is not evolution, but rather the bearing of evolution on teleology, or the doctrine of the final causes of things. Paley, Chalmers, and the authors of the Bridgewater Treatises laid special stress on the argument from design, and, indeed, the chief object they had in view in writing their books, which were classics in their day, was to exhibit the purposiveness of Nature, to prove that from the evidence of design, which is everywhere manifest in the visible universe, we must necessarily infer the existence of a designer. And so conclusive was the argument, as then framed, that even the most skeptical and those most opposed to revealed truth were forced to admit that the facts of Nature bear witness to the existence and controlling influence of mind in the universe. Voltaire declared, "*Rien n'ébranle en moi cet axiome, tout ouvrage démontre un ouvrier*"; and Hume, in words no less positive, affirmed that "the whole frame of Nature bespeaks an intelligent maker."

With the appearance, however, of Charles Darwin's epoch-making *Origin of Species* it was at once recognized on all hands that the design argument had to be materially modified if it were any longer to have the slightest validity. As for the exponents of the mechanical school of philosophy, especially those who rejoice in the new-

* See the writer's work, *Bible, Science, and Faith*, Part I.

fangled name of Monists, they loudly and triumphantly proclaimed that it was all over with teleology, and that it could, without further ado, be relegated to the limbo of exploded theory and fanciful hypothesis. Büchner asserted that "modern investigation and natural philosophy have shaken themselves tolerably free from these empty and superficial conceptions of design, and leave such childish views to those who are incapable of liberating themselves from such anthropomorphic ideas, which, unfortunately, still obtain in school and Church to the detriment of truth and science." * And Haeckel, with his usual dogmatism, writes, "I maintain with regard to the much-talked-of purpose in Nature, that it really has no existence except for those persons who observe phenomena in plants and animals in the most superficial manner." †

The more profound and philosophic men of science did not, however, share the notions of Haeckel and Büchner. They admitted, it is true, that the teleology of Paley and of the authors of the *Bridgewater Treatises* was no longer tenable, but they did not, therefore, conclude that teleology was completely annihilated. Far from it. Teleology, they said, must be modified so as to meet the demands of modern science and research, and, as so modified, it is stronger, nobler, and more comprehensive than ever before. So thought among others Huxley and Gray, and so think also Wallace, Mivart, and the Duke of Argyll.

"The most remarkable service to the philosophy of biology rendered by Mr. Darwin," writes Huxley in his *Darwiniana*, "is the reconciliation of teleology and morphology, and the explanation of the facts of both which his views offer. . . . It is necessary to remember that there is a wider teleology which is not touched by the doctrine of evolution, but is actually based upon the fundamental principle of evolution." ‡

America's great naturalist, Prof. Asa Gray, is no less explicit. "Let us," he says, "recognize Darwin's great service to natural science in bringing back to it teleology, so that, instead of morphology *versus* teleology, we have morphology wedded to teleology." *

"The idea of development in all its logical forms," declares the Duke of Argyll, in his late admirable work, *The Philosophy of Belief*, "is not antagonistic to, but in perfect harmony with, the idea of purpose. Design, from first to last, from its first conception to the attainment of its farthest aims, is, and so far as we know, must be a process of development. That development may be slow, or it may be quick and sudden in its steps. It may be effected in ways widely various, as by outward building or inward growth, but its

* Force and Matter, p. 218.

† History of Creation, vol. i, p. 19.

‡ Page 110.

* *Darwiniana*, p. 288.

one essential character remains unchanged. It is a peculiar relation of cause and effect operating in time and exhibiting the one essential characteristic of having been directed in the past, and of being continually directed in the present, to some end which is future, the direction being of that nature which we instinctively and accurately call an aim." *

In a recent article on Darwinism and Design, in the *Contemporary Review*,† Prof. F. C. S. Schiller concludes his interesting contribution as follows:

"We have discussed so far only mechanical theories of evolution. But in itself evolution is not necessarily bound to be mechanical; it is perfectly possible to regard it as the gradual working of a divine purpose. And once we adopt the evolutionist standpoint, it is clear that the argument from design is materially and perceptibly strengthened: (1) Positively, because evolutionism lets us, as it were, behind the scenes and shows us how means are adapted to ends in the gradual process of evolution. This renders easier and more comprehensive the belief underlying all teleology in a power that intelligently adapts means to ends. (2) Negatively, evolutionism greatly weakens the objection to the teleological argument based on the imperfection of existing adaptations. We are no longer compelled to proclaim everything perfect; it suffices that we can find nourishment for the faith that everything is being made perfect.

"If, then, evolutionism strengthens the argument from design, the latter indirectly owes a debt of gratitude to the theories which have led to the general adoption of the evolutionist standpoint. And among these Darwinism stands pre-eminent. Evolutionism was as old as one of the earliest Greek philosophies; but it was not until Darwinism made it a household word that it could force its way into the consciousness of men at large. And as a philosopher who regards evolutionism in some form as affording the most hopeful method of approaching the mystery of existence, I am inclined to hold that when historical perfection has cleared away the mole-hills we have made into mountains, it will be here that will be found Darwin's most momentous and enduring service to knowledge and to mankind."

From the foregoing it would seem that all unbiased minds should be forced to acknowledge that teleology, far from being weakened or completely eliminated from the circle of the sciences, is, on the contrary, demonstrably in a far more impregnable position than ever before. We have, however, to deal with a certain class of agnostics who insist on reducing everything in creation to force

* Pages 145 *et seq.*

† June, 1897, p. 883.

and matter, and all the phenomena which can come under our observation to the action of force on matter, or to the fortuitous clash of atoms and molecules. They wish to eliminate from their discussions all reference to a creative, directive and intelligent Mind, for, as they contend, such a mind is not only unnecessary but is something which is absolutely unknowable and unthinkable. Eliminating mind from the universe means eliminating purposiveness from Nature, and carries with it, of course, the destruction of all forms of teleology.

Herbert Spencer's works, for instance, are remarkable for their undisguised attempt entirely to eliminate all teleological language and eschew all teleological implications. But, strive as he may, the great corypheus of agnosticism is utterly unable, even in the simplest definitions, to find language that does not, directly or indirectly, imply aim and purpose, and, consequently, an intelligent designer. Thus, in his *Principles of Biology*, he says that "physiology, in its concrete interpretations, recognizes special functions as the ends of special organs; regards the teeth as having the office of mastication; the heart as an apparatus to propel blood; this gland as fitted to produce one requisite secretion, and that to produce another; each muscle as the agent of a particular motion; each nerve as the vehicle of a special sensation or a special motor impulse." *

All this, however, is teleological language of the most pronounced character. It is seen in the word "function," which implies adaptation and, consequently, preparation and purpose; it is seen in the word "end," which here signifies "aim"; it is seen in the word "apparatus"—*ad-paratus*—which means a mechanism contrived for a specific purpose or operation—a means devised for obtaining some special end, for accomplishing something which has been foreseen and intended. Similarly the words "office," "agent," "fitted to," "recognizes," are all teleological, and replete with the idea of mental purpose. In spite, then, of all agnostic philosophy, in spite of all abstractions which would distort the original signification of words, we have in this simple definition of Spencer's words which are positively surcharged with teleology. But they do no more than express what the observer actually sees and what actually takes place in the economy of Nature. In spite, therefore, of all his attempts to avoid teleological terms, Spencer, like others of his school, is forced, by the very nature and structure of language, to employ them and to make use of expressions which indicate aim, preparation, purposiveness; which imply intelligence, foresight, design, a designer.

* Pages 165 *et seq.*

One of the reasons, no doubt, why certain modern philosophers and men of science have made such onslaughts on teleology is to be found in the too common attribution to teleologists of a crude anthropomorphic conception of the Deity. "The idea of a superintending and designing Mind" conveys, it is asserted, "an unworthy idea of a Supreme Being. It lowers the Creator to the level of an artificer."

"But, whether the idea be unworthy or not, it is fair to remember," as a writer in a recent number of the London Quarterly Review pertinently remarks, "that, if Supreme Mind works in Nature, it can only be through such mental characteristics as are recognizable by men that such a mind could disclose itself. The objection demands a loftiness of method which would serve to conceal its intelligence from the intelligent creatures of its hand. But, further, the divine working is not wholly like the human; it is loftier; it is not the process of a mere artificer. Man produces manufactures; the Divine Mind produces growth and development. It thus works in a fashion more majestic than man's. This conception of the difference between divine and human working does not dissipate the impression that mind works in Nature. There is a distinction in man's workmanship between the mental conception and mechanical execution. This is a real and constant distinction. In Nature this distinction disappears, but the important question here is, Is the conceiving mind lost in the mechanical artificer? This is precisely what does not happen. In the slow, orderly, and well-directed processes of Nature it is the lower—the artificer—action which vanishes; the evidence of the ruling mind remains unimpaired. The objection, therefore, rests on an incomplete analysis. It confounds the high functions of a conceiving mind with the far lower functions of a mere executive mechanic." *

Another reason for the prevalent confusion of thought regarding the relation of teleology to evolution arises from erroneous notions entertained by so many respecting the true signification of creation and evolution. They fail to distinguish between absolute creation *ex nihilo* and derivative creation. Absolute creation embraces only spiritual intelligences and the material elements of which the universe is composed. Derivative creation, on the contrary, means only the formation of something from pre-existing material, and includes all organic and inorganic compounds, all forms of vegetable and animal life, for all these have been produced from those elementary bodies which constitute alike the earth and all the orbs of the firmament. Only absolute creation, therefore, is creation properly so called. Derivative creation, however, is

nothing more than development under the action of the laws of Nature imposed by God on the elements in the beginning. It is evolution from lower to higher forms under the action of what St. Thomas calls the Divine Administration, and in consequence of the action of what St. Augustine terms seminal reasons—*rationes seminales*. Absolute creation is direct, immediate, supernatural; derivative creation is indirect, and is effected by the Almighty through the agency of secondary causes. In the beginning God created the elements once for all, but on these simple elements he conferred the power of evolving into all the countless forms of beauty which now characterize the organic and inorganic worlds. What, then, the older theologians called secondary or potential creation or formation—development under the guidance of God's providence—we may now call, and with the utmost precision of language, evolution. For God, as St. Augustine observes, did not create animals and plants directly, but potentially and causally—in *fieri*, in *causa*; *potentialiter atque causaliter*. This, however, is theistic evolution, not agnostic evolution which relegates God to the region of the unknowable; nor atheistic evolution which finds in the chance interaction of eternal force and eternal matter an adequate explanation of all the problems of the existing universe. For, let me insist, evolution does not and can not account for the origin of things. The best it can do is to throw some light on their historical development; and this for the simple reason that it does not and can not deal with the origin of things, but only with the *modus creandi*, or rather with the *modus formandi*, employed by Omnipotence, after the universe had been called into existence by divine *Fiat*. "Evolution, then," as I have elsewhere shown,* "postulates creation as an intellectual necessity, for if there had not been a creation there would have been nothing to evolve, and evolution would, therefore, have been an impossibility.

"And, for the same reason, evolution postulates and must postulate a Creator, the sovereign Lord of all things, the Cause of causes, the *terminus a quo* as well as the *terminus ad quem* of all that exists or can exist. But evolution postulates still more. In order that evolution might be at all possible, it was necessary that there should have been not only an antecedent creation *ex nihilo*, but also that there should have been an antecedent involution or creation *in potentia*. To suppose that simple brute matter could, by its own motion or by any power inherent in matter as such, have been the sole efficient cause of the evolution of organic from inorganic matter, of the higher from the lower forms of life, of the rational from the irrational creature, is to suppose that a thing can

* Evolution and Dogma, pp. 431, 432.

give what it does not possess, that the greater is contained in the less, the superior in the inferior, the whole in a part."

Still another difficulty for the opponents of teleology arises from their inability to understand the purpose of many things in Nature. This, however, far from being an objection to the argument from design, should only make one more conscious of his ignorance, and of the limitation of human knowledge. If we can discern manifest evidence of design—and this no reasonable man can deny—in even a few things, and if, of the manifold purposes exhibited in any given object, we can discover but one, we have evidence which is quite sufficient for the validity of the design-argument, and quite sufficient, likewise, to meet all the requirements of the teleologist.

It is, indeed, passing strange that those who are always so prompt to deny the existence of purpose in Nature, when there is question of teleology, or when theological implications are suspected, are the very first to insist on the evidence of mind and purpose when in their own case it is demanded by the exigencies of argument or discovery, and especially when it is demanded by the exigencies of special pleading.

A case in point is the argument for the great antiquity of man based on the existence of arrowheads and flint flakes, found in certain deposits whose age is indisputable. Contrary to the traditional view regarding the recent advent of man on earth, we have anti-teleologists who claim as the date of the appearance of our race one which carries us back tens, yea, hundreds of thousands of years. And on what do they base their argument? On evidences of mind and purpose. The arrowheads and flint flakes, they declare, and rightly, could not have been fashioned by chance; they could not have been formed by even the highest representatives of the brute creation. They indicate intelligence, design. They must, therefore, have been produced by man. Man, therefore, must have existed long prior to the period usually assigned as the date of his apparition on our planet.

Now, while no one can object to the argument, as thus presented, we find it strangely inconsistent that its validity should be questioned where the evidence of mind and purpose is far more striking—to wit, in the multifarious phenomena of the universe, all of which betoken far more than human intelligence and power. I shall here limit myself to only a single but a most telling illustration—the preparation of the world as the dwelling place of man. The storage of coal as fuel, the introduction of certain plants and animals shortly before the advent of our species, and in strict correlation with it—plants which were almost indispensable as articles of food, and the appearance of animals, such as the sheep, cow, and horse, which

contribute so materially to our comfort and enjoyment—can never, by any sane man, be regarded as the result of mere fortuity, or of the blind and indeterminate action of force on matter. No, the whole grand march of development from the Archæan to the Quaternary period, from the simplest forms of life to the most complex, from monad to man, all speak in the most eloquent and unequivocal language of mind and providence, of a Being who foresees, designs, directs, governs; who in the language of Holy Writ “reacheth from end to end mightily and ordereth all things sweetly”; “Who hath ordained all things in measure, and number and weight.”

But teleologists, while maintaining that design and purpose are everywhere manifest in Nature, and while proclaiming that everything is under the government of law, are not guilty of the error into which materialistic scientists so often lapse—that is, of regarding law as a cause, or a power, or as a kind of demiurge independent of the Deity. Far from it. Law in itself is nothing, does nothing, explains nothing. Law is not a force, is not an agent, is not and can not be the efficient or operative cause of anything whatever. Law is only the method according to which force acts; it is but the expression of the mode of divine action. Science has been able to discover a few of the laws of Nature, as it has been able to disclose evidences of design and purpose in the divers realms of creation. And as from the few known laws of Nature men of science are justified in asserting that the entire universe and all it contains are governed by law, so also is the teleologist, from the knowledge he already possesses, equally warranted in declaring that not only the world as a whole, but also everything in it, attests the presence and action of Mind and exhibits such obvious traces of purposiveness that it may truthfully be affirmed that the doctrine of final causes reposes on as firm a basis as does the teaching, universally accepted, that the whole of Nature, animate and inanimate, is under the control of divinely imposed law.

No, it is not true that teleology has been banished from science and theology by recent research, or by the confirmation which is daily being given to the theory of evolution. Teleology has been modified, not destroyed. It has been expanded and ennobled and rendered more subtle and comprehensive than ever before. We now no longer look upon the Creator as directly producing the myriad species of plants and animals which variegate and beautify this earth of ours, but we regard him as operating through secondary agents—creatures of his hand, ministers of his wisdom and power. He is not the immediate cause of the infinitude of forms which characterize the organic and inorganic worlds, but rather the *Causa Causarum*. He is not, as St. Athanasius observes, a car-

penter, but a creator—*κτιστής οὐ τεχνίτης*. In the beginning he created all things and then impressed on them the power of development, of evolving into the innumerable species we now behold. All things existed in idea before they existed in fact, and the design and purpose which are revealed in animate and inanimate Nature are the witnesses of the foresight and providence of creative wisdom.

Paley and the older school of teleologists pointed to a watch as a beautiful and convincing evidence of design. To the modern teleologist, studying the universe in the light of evolution, it is not simply a watch that presents itself as a witness of purpose running through all things created, from atom to star, but it is a watch which is competent to produce other and better watches. God makes things, it is true, but he makes them by making them make themselves. Similarly, we read purpose in Nature not only by limiting our view to the present and to simple individuals, but also, and more particularly, by studying the species and the class to which individuals belong, in the light of their past history or in the changes they may undergo in the future by reason of varied conditions or continued development. In the words of Mr. Aubrey L. Moore: "If ontogeny, the history of the individual, gives us no answer, we fall back on phylogeny, the history of the race. Organs, which on the old theory of special creations were useless and meaningless, are now seen to have their explanation in the past or in the future, according as they are rudimentary or nascent. There is nothing useless, nothing meaningless in Nature, nothing due to caprice or chance, nothing irrational or without a cause, nothing outside the reign of law. This belief in the universality of the reign of law is the scientific analogue of the Christian's belief in Providence." *

THE principal feature in the orography of South America, from Cape Horn northward, says Mr. Otto Nordenskjöld, in describing his journey in southwestern Patagonia, is the contrast between a high Pacific mountain chain and a wide Atlantic table-land. This circumstance causes different parts of the country to wear aspects that are very dissimilar, but nowhere does the contrast appear so strongly as in Tierra del Fuego, where the summits of the Cordilleras, covered with perpetual snow, and very often also by clouds, rains, and fog, can all be seen from the dry Atlantic coast. Not quite so rapid, but still very wonderful, is the transition in Patagonia; and the region lying between 50° and 52° south latitude is in addition more interesting than any part of Tierra del Fuego, owing to the peculiar character given to parts of it by the presence of masses of basaltic rocks and lava cones in the east, and of great ice fields in the western valleys.

* Science and the Faith, p. 197.

DISCOVERY OF NEW CHEMICAL ELEMENTS.

BY CLEMENS WINKLER.

IN his studies of the relative frequency of the different elements composing the crust of the earth, Mr. F. W. Clarke supposes that to a depth of ten miles below the level of the sea the composition of the ground is the same as is given by the examination of the surface strata and the depths which we have reached. The mean specific gravity of these strata is 2.5, or not quite half the density of the earth as a whole. Including the oceans and the atmosphere, the exterior crust of the earth is composed half of oxygen and one fourth of silicon, while the other fourth is represented by other elements—aluminum, 7 per cent; iron, 5.10; calcium, 3.50; magnesium, 2.50; sodium, 2.20; and potassium, 2.20 per cent. Some of the elements of which the numerous compounds have long been very obvious to the human ken are, therefore, from the point of view of their quantity, of very little importance; thus, hydrogen stands for only 0.94 per cent of the general composition of the crust of the earth, carbonic acid for 0.21 per cent, phosphorus for 0.09 per cent, and nitrogen for 0.02 per cent. These elements, which are the constituents of immense seas and form the basis of life, therefore furnish only a minute fraction of the mass of the ten-mile-thick ring contemplated by Mr. Clarke. Since the soundings thus far made indicate that they do not exist or hardly exist at greater depths, we have a right to say that so far as regards quantity they may almost be neglected, in considering the mass of the whole globe. The content in chlorine does not exceed 0.15 per cent, yet the common salt alone held in the oceans is sufficient to cover all the continents and bury the highest mountains.

We perceive from this showing how little the impression the outer surface of our globe gives us corresponds with its real nature as we judge of it from its mean density. There can not be the least doubt that the internal parts of the globe are composed of different substances from those which appear in the external strata.

But, while the elements of light specific weight or great volatility which, like hydrogen and nitrogen, exist in large quantities around us, constitute only a very minute part of the constituents of our globe considered as a whole, we presume that the elements called rare only enter in an infinitesimal degree into the general composition of the earth; the more so, because, so far as we as yet know, these elements are not found at great depths. I, at least, do not know that the heavier metals—gold, silver, lead, etc.—have ever been found in the materials extracted from deep soundings or

volcanic ejections. After the mighty eruption of Krakatoa, for example, I sought in vain for these elements in the cinders cast out, which probably came from great depths. The supposed discovery of a new element in the ancient lavas of Vesuvius has been found to be erroneous.

Elementary bodies seem to multiply as we approach the surface of the globe. Two hypotheses suggest themselves in explanation of the fact: that of displacements of cosmical matter, and that of the new formation of elements on the surface.

The displacements of cosmic materials are incessant; falls of meteorites furnish a particularly striking example of them, but it is probable that as to quantity the cosmical dusts are of more importance. Yet neither the meteorites found at various points nor the dust collected by Nordenskiöld in the ice fields of the polar regions, the extra-terrestrial origin of which can not be doubted, contain the rare elements of the earth. The hypothesis of an increase by accretions from without appears to lack foundation.

The new formation of elementary bodies seems to be still less probable; at most it might be explained by the possibility, often indicated but never established, of a new reduction of bodies heretofore supposed to be simple. Spectrum analysis, it is true, reveals to us transformations which are gradually going on in the matter of the fixed stars, but they are only of known substances becoming converted into other substances equally known. Moreover, the conditions of temperature and aggregation of the fixed stars and those of the earth can not be compared.

It is evident that the increase of simple bodies in the outer strata of the earth is only apparent. It should be recognized, besides, that science has made great progress, and this progress can not be without influence on the discovery of new substances. The first electrolytic decompositions accomplished by Davy with an inferior voltaic pile made known at the beginning of this century the existence of metallic radicles in the salts and the earth of which there had not been before the slightest suspicion; while Moissan, by the employment of the powerful currents now available, has been able to disengage fluorine—hitherto almost unknown—from its combinations. Spectrum analysis has cast light on a whole series of elements of characteristic spectra. The presence of one of these elements, helium, had been demonstrated in the sun before it was known that it likewise entered into the composition of our globe. The conclusions drawn by D. Mendeleef from the periodical law have also led to the discovery of several elements the existence of which was indicated by theory before the chemist had isolated them. I mention, first, scandium, discovered in 1879 by Nilson in exonite,

gadolinite, and yttrötitanite. This metal, the oxide of which exists only in quantities of a few grammes, and which no person, perhaps, other than the author of the discovery has had in his hands, possesses considerable scientific importance, because its atomic weight of 44, as determined by Nilson, is precisely that indicated by Mendeleef for *ekabor*, an element the existence of which was predicated by the periodic law.

In 1794, Gadolin had separated from the gadolinite of Ytterby an earth which he called the earth of Ytter, and which was afterward known under the forms of erbia, terbia, and yttria proper. These earths were found in a considerable number of rare minerals, but the oxides extracted from these minerals exhibited different natures and aspects, presenting themselves rather like mixtures in which the separation of the different constituents was attended by considerable difficulties, for the different elements gave no very distinct reaction. It was necessary to recur to spectrum analysis and to the determination of atomic weights, and to try to isolate them by repeated fractionings, under the action of sulphate of potassium or of ammonia, or else by the partial decomposition of the nitrates by heat. The bulk of these analyses, the results of which are not, however, entirely clear as yet on some points, have been performed within the last quarter of a century, and, besides securing more precise knowledge of scandium and yttrium, have revealed the existence of numerous other rare elements, the reduction of which does not seem impossible; among which we cite erbium, holmium, thulium, dysprosium, terbium, gadolinium, samarium, decipium, and ytterbium.

Cerium, lanthanum, and didymium have been the object recently of very attentive researches having a practical end in view—the constitution of mantles for incandescent gaslights. Didymium has been long suspected of not being a simple substance; but Carl Auer von Welsbach, the inventor of this method of illumination, is entitled to the credit of having succeeded, in 1855, in separating didymium into its two elements of præsodidymium and neodidymium. The utilization of monazite afterward permitted the preparation of the salts of these remarkable metals in larger quantities, and the practical use of them.

The existence of metacerium, announced by M. Brauner, does not yet appear to be fully established, nor that of russium, which M. Crushchow has found associated with thorium in some zircons and in monazite, and the atomic weight of which is calculated at 220. The jargonium of Sorby, the austrium of Linneman, the norvegium of Dahll, the actinium of Phipson, the idumium of Websky, the masrium of Richmond and Off, and

an unknown element which M. K. J. Bayer thought he had found in French bauxite, have returned to nothingness. We mention also merely as a matter of curiosity a kosmium and a neokosmium, deriving their names not from Cosmos, but from Kosmann, who took out a patent for the preparation of their oxides.

Gallium was discovered in August, 1875, by Lecoq de Boisbaudran in the blende of Pierrefitte, through two very distinct lines in the violet of the spectrum of that mineral, which, however, as afterward appeared, contained only a slight proportion of the new metal—not exceeding 0.0001 per cent—while in the richer blende of Bernbryer it amounted to 0.001 per cent. The preparation of gallium in any considerable quantities was attended with great difficulties on account of the want of a proper mineral to be practicably submitted to the extraction process, and none has as yet been found. Still, the study of the new metal was very interesting, in view of the theoretical speculations of Mendeleef. Scandium and germanium had not yet been discovered, and there was therefore nothing to justify or confirm the conclusions drawn from the law of periodicity. As early as 1869, Mendeleef had affirmed the existence of simple bodies still unknown, the atomic weights of which should be comprehended between 65 and 75; he had even gone so far as to describe in detail the properties of the three hypothetical elements—*eka-boron*, *eka-aluminum*, and *ekasilicon*. We can imagine the interest attached to the question whether the properties of gallium corresponded with the anticipations of the Russian chemist.

At first, the correspondence did not seem to exist; the determinations made on the small quantities of gallium that could be obtained gave the specific gravity the unexpected value of 4.7. But as many of the properties of the new metal—such as the precipitation of its solutions by carbonate of barium, its tendency to form basic salts, and its capacity of forming alums—denoted a relationship with aluminum, Mendeleef had no hesitation in declaring that the new element appeared to correspond with the one the existence of which he had indicated in 1874 as similar to aluminum, and which he had called *eka-aluminum*. A new determination, made with considerable quantities of gallium obtained by electrolysis, brought the value of the specific gravity up to 5.9, which correspond exactly with the value calculated by Mendeleef for the hypothetical *eka-aluminum*. The specific heat (0.08) was afterward found to correspond with Mendeleef's estimate, and the justness of his previsions was established. It was therefore shown to be reasonable to deduce from the properties of known elements those of others still unknown, but the existence of which is anticipated. Mendeleef had not expected so quick a confirmation of his

previsions; but his triumph was destined to be still more complete, for to gallium were afterward added *scandium* (ekaboron), discovered by M. L. F. Nilson in 1875, and *germanium* (ekasilicon), discovered by me in 1886.

The discovery of germanium, predicted under the name of ekasilicon by Mendeleef, bears a resemblance to the discovery of the planet Neptune, the existence of which had been shown by the calculations of Adams and Leverrier. That discovery was not due to a concurrence of favorable circumstances or to a happy accident, but was the result of researches inspired by theoretic previsions, and the concordance between the predicted and the real properties was so great that Mendeleef regarded the discovery of germanium as an important verification of the periodic law. On only one point—that touching its formations in Nature—did germanium completely fail expectations. The search for it would be more likely made as an oxide in the rare minerals of the north, along with titanium and zirconium, than as a sulphide accompanying similar compounds of arsenic and antimony in gangues of silver-bearing minerals. This fact, with the comparative rarity of its mineral, argyrodite, has contributed no little to delaying the elucidation of its real character. For myself, I was at first inclined to regard it as eka-antimony, while Mendeleef, after my first incomplete communications, thought it was ekacadmium. At the same time, M. von Richter expressed the conviction that germanium was nothing else than the long-expected ekasilicon, a conclusion that was justified by the correspondence of atomic weights.

The success of the bold speculations of Mendeleef permits the affirmation that the elaboration of the periodic system constitutes a great forward step for science. In the course of only fifteen years all the predictions of the Russian chemist have been confirmed. New elements have come to fill the vacant spaces in his table, and there is every reason to hope that a like fulfillment awaits the rest of the natural system.

Yet the two elements last discovered, *argon* and *helium*, do not seem to present any relation with the periodic system. The physical properties of argon are very distinct; its characteristic spectrum distinguishes it with great certainty from all other substances; but chemically the gas manifests an extraordinary indifference, and it has not so far been possible to make it enter into the usual compounds with other elements. This peculiarity, and the impossibility of introducing a simple body of the molecular weight of argon (39.88) into the periodic system, have given occasion to all sorts of hypotheses concerning the gas; and the question of its relations has not yet been answered.

Another most interesting discovery is that of helium, which was made by Professor Ramsay, in 1895, while examining the mineral cleveite for argon, when, besides the spectrum of argon, he observed another bright line not belonging to that spectrum, which Mr. Crookes recognized as identical with the line D^3 which Professor Lockyer had observed in 1868 in the spectrum of the solar chromosphere, and which he attributed to an element not yet known on the earth—helium. The same line was afterward found in the spectra of other fixed stars, and the conclusion was drawn that helium exists in large quantities outside of the earth. On our planet it seems, however, to be very rare, and may even be ranked among the rarest elements. Yet it has been almost discovered several times. Palmieri observed the line of helium in his researches on the lava of Vesuvius, but did not push the matter further; and Hillebrand in 1891 obtained in the spectrum of the gas formed by uranite lines which were presumptively those of helium. Since its discovery, helium has been found in a considerable number of minerals, generally associated with uranium, yttrium, and thorium; in mineral waters and, in extremely small quantities, in atmospheric air. Next to hydrogen, it is the lightest of the gases, and from this peculiarity Stoney draws an explanation of the fact that these two elements exist only in very small quantities in a free state on the earth, while they are diffused in enormous masses through the universe. The relatively small force of the earth's gravitation does not furnish an adequate counterpoise to the velocity of their molecules, and they escape from the atmosphere of the earth, unless they are restrained by chemical combination. They then collect around the great centers of attraction constituted by the stars, in the atmosphere of which they exist in large quantities.

The study of the spectrum of helium is extremely important, because it gives interesting data concerning the nature of distant celestial bodies. It also, as the labors of Runge and Paschen have shown, suggests doubts concerning the elementary character of the new substance. Whatever it may be, if we have to suppose that helium is composed of two gases (Mr. Lockyer has proposed the name of *asterium* for the second), one of the two gases probably has a boiling point very near the absolute zero, and in any case below -264° C.; for the master in liquefaction of gases, M. K. Olszewsky, has not up to this time succeeded in provoking a change of state of helium, and he proposes to use this gas for filling gas thermometers for measuring extremely low temperatures. Helium has shown itself thus far as refractory as argon to all chemical combination, and so great an uncertainty reigns over the position to be attributed

to it that I pass by the hypotheses that have been set forth with respect to the matter.

It is not impossible that the discovery of these two new elements, argon and helium, may give occasion for a remodeling or a transformation of the periodical system—a remodeling by means of which some uncertainties and even contradictions now existing will undoubtedly be removed. Thus, for example, the atomic weight of tellurium, as recently determined by B. Brauner and Ludwig Standenmaler, does not enter at all into the periodical system; on the other hand, the existence in this substance of a foreign element, such as the *austriacum* suggested by B. Brauner, does not seem to be established. As to the much-agitated question whether and to what extent the atomic weight of nickel differs from that of cobalt, I believe I have given a satisfactory answer, and have refuted the hypothesis of Gerhard Krüss and F. W. Schmid of the existence in one of the substances of a third element which has been called *gnomium*.

The rapid glance which we have cast over the discovery of new elements during the last twenty-five years shows that researches have been pursued in this direction with great activity, and with the return of considerable results. Yet the speculations for which these researches have given occasion with respect to the possibility of an ultimate decomposition of apparently simple bodies, and reciprocally respecting the progressive development of the primitive substance and the formation of many of the present elements, may be considered very uncertain. I mention among these Mr. Lockyer's hypothesis of the dissociation of the elements within the solar atmosphere. Hypotheses of this kind must remain hypotheses so long as we do not succeed in splitting a substance unequivocally regarded as simple, or in transforming some element into another; yet they need not be considered wholly inadmissible. Something unexpected may happen at any time that will open to science new roads of investigation.—*Translated for the Popular Science Monthly from the Revue Scientifique.*

FROM the results of an investigation as to the use of fermented drinks by prehistoric peoples, M. G. de Mortillet concludes that the lake dwellings of Clairvaux in the Jura and of Switzerland show that the neolithic people of central Europe had a wine made from raspberries and mulberries; and the dwellings of Bourget in Savoy and various stations in the Alps, that the use of this wine continued through the bronze age. On the southern slope of the Alps the relics of the dwellings between the prehistoric and the protohistoric ages reveal the use of another fermented liquor, prepared from the dogwood. Traces of the use of wine from grapes are found in the terramares of the plain of the Po, going as far back as the earliest bronze age.

THE SIGNIFICANCE OF LANGUAGE.

BY MICHEL BRÉAL.

NONE of the works on linguistics which come out one after another, whether for the use of students or of the general public, seem to me to offer exactly what they ought. To one who knows how to question it, language is full of lessons, because man has laid up in it for many centuries the acquisitions of his material and moral life. If only the changes of vowels and consonants are considered, the study is reduced to the proportions of a secondary branch of acoustics and physiology; if the study is directed to the counting of the losses suffered by the grammatical mechanism, it gives the illusion of a building falling to ruin; and if one confines himself to vague theories on the origin of language, he adds a chapter of not much value to the history of systems. It seems to me that there is something else to be done. The extraction from linguistics of what can be drawn from it as food for reflection and as a rule for our own language (since each of us is doing his part in the evolution of human speech) is the thing that should be made most prominent, and that I shall attempt.

My present effort is to study the mental causes which have influenced the transformations of languages. In order to give system to the investigation, I have arrayed the facts under a series of laws—to which term we must not attach an imperative significance, for none of these laws is without exceptions; and I take pains to define for each law the limits within which it is operative. I aim to show that the history of language, besides achieved changes, furnishes numerous cases of attempts that have been carried only part way.

To introduce the will as a factor in the history of language after so much pains have been taken within the past fifty years to exclude it, seems almost like heresy. But while it was proper to discard the puerilities of the science of the past, we have been content to take up with the opposite extreme of a too simple psychology. We shall have to shut our eyes to the evidence to fail to see that an obscure but persevering will presides over changes of language.

How shall this will be represented? I believe it should be represented under the form of thousands and millions and millions of tentative essays, usually unsuccessful, but sometimes followed by a quarter or a half success, which, thus guided, corrected, and improved upon, at length take some precise direction. The object, in language, is to be understood. The child exercises itself for months in speaking the vowels and articulating the consonants; and how many failures does it make before it clearly pronounces a

syllable! Grammatical innovations are of the same kind, with the difference that a whole people collaborates in them. How many awkward, incorrect, and obscure constructions, before finding the one which will be, not an adequate—for there is none such—but a passably sufficient expression of the thought! There is nothing in this long labor that is not of the will. In pursuing this study, we have no need to look for facts of a complicated nature. As in everything where the popular mind is in play, we find a surprising simplicity in the means, in striking contrast with the extent and importance of the effects. I have designedly taken my examples from the best known languages.

We give the name of *repartition* to the intentional process by which words that were synonymous take on different meanings, and can no longer be used for one another. Most linguists deny that there are repartitions, and, when confronted with examples, assert that they are made by scholars and are not popular. The public, however, are not of this opinion. They admit the existence of repartition, and do not believe that there are two absolutely identical terms. Now, since the public is the depository and the author of language, its verdict that there shall be no synonymy is effective to work the disappearance of any synonym in a short time. A class of distinctions between words is discredited by their having been made in the study by pretentious teachers of language who have not been called to the task. There are no real distinctions other than those which are made without premeditation, under the pressure of circumstances by sudden inspiration, under the impulse of a real need, by persons who are dealing with the things themselves, associating the words with them the moment they see them.

When two languages or two dialects exist together, a work of classification takes place, and synonymous words are given different ranks. Words rise and fall in dignity as an idiom is considered superior or inferior. Linguistics is here a social or a national affair. As M. J. Gillieron relates of the Lower Valais, where French has encroached upon the Swiss dialect, that the latter has been debased and become vulgar and trivial. Since the French word *chambre* has come in for the bedroom, the old word *pailé* has been applied only to the garret. In Brittany, according to the Abbé Rousselot, gardens were formerly called *courtîls*, but now that the word *jardin* has been introduced, a kind of slight has been attached to the old rustic word. It makes no difference if both terms are of the same origin. The Savoyard calls his own parents *père* and *mère*, French, while the fathers and mothers of his cattle are his native *pâré* and *mâré*. What the people do by instinct, all constructive science, all deep analysis, all discussion that has an object, every reflective opinion that would

define itself, does with the same spontaneity. Two words, formerly synonymous, are differentiated by an immediate apperception. The history of language is a series of repartitions. The earliest stammering of a child is nothing else, for it is by repartition that he applies to distinct objects the syllables which he at first bestowed indifferently on everything he met.

When the popular mind has once determined a repartition of a certain order, it is naturally tempted to complete the series. There are languages in which the different acts of life are not designated in the same way when performed by a person of high dignity and by a common person. To express that a man eats, the Cambodians use the word *si*; in speaking of a chief, *pisa*; and of a bonze or king, *soi*. In speaking to an inferior, I is *anh*; to a superior, *knhom*; to a bonze, *chhan*. The followers of Zoroaster, who regard the world as divided between two opposing powers, have a double vocabulary, according as they speak of creatures of Ormuzd or of Ahriman.

Nothing, in fact, is more natural or more necessary than repartition; for our mind collects words from different ages and different mediums, and would be in absolute confusion if it did not give some kind of order to them. We all do what the dictionaries of synonyms do; when we examine the terms which usage distinguishes or subordinates, we find that etymology rarely gives a reason for the differences we assign to them. If we take, for example, the words genus and species, what reason is there for giving one a larger capacity than the other? There is nothing in the words *division*, *brigade*, *regiment*, and *battalion* to indicate the special and exact subordination of one to another that exists between them. Passing to moral ideas, we perceive no gradation imposed by etymology in the words *esteem*, *respect*, and *veneration*. It required precise and clear minds, a society well ordered and careful of its ranks, to establish some of these distinctions.

Still, repartition has its limits. First, as it does not create, but attaches itself to what is to be distinguished, terms to be differentiated must exist in the language. We might cite instances of confusion from which, for the lack of a word, the most perfect idioms have never succeeded in freeing themselves. On the other hand, the mind may not always be able to fructify all the riches the language offers it. Grammatical mechanism, by combining existing elements, could produce such a quantity of forms that the mind would be embarrassed with them. George Curtius calculated that the number of personal forms in the Greek verb rose to 268, but this is much inferior to the 861 forms of Sanskrit. Another limit is imposed. Certain shades of meaning are possible only among cultivated peoples. In synonymy we can discern what objects the thought of a nation is occu-

pied with. Distinctions are made first by the finer minds; then they become common to all. Intelligence consists largely in perceiving the difference between similar things. It is imparted, in a certain degree, by language, for, in order to recognize differences which the best endowed were at first the only ones to feel, the view of each one becomes keener.

From what has gone before, we draw the conclusion that language designates things incompletely and inexactly. Substantives are labels attached to things, and include just that part of the truth which a name can contain. The names most adequate to their objects in our languages are abstract nouns, because they represent a simple operation of the mind. When I pronounce the word *compressibility* or *immortality*, all that is in the idea is contained in the word; but if I take a real being, an object existing in Nature, it will be impossible for language to put into the word all the notions which that being or that object awakens in the mind. Language is forced to select. Among all the notions it chooses one, and thus creates a name which at once becomes a sign.

There is no reason to fear that the importance of language in education will ever be depreciated. We can trust that to the mothers. Their first impulse is to speak to the child, their highest joy to hear it speak. Then come masters of all degrees and sorts, each of whose art supposes language. In every country, ancient and modern, language has supplied the instrument and the prime material of instruction. This universal agreement is natural. We shall have no difficulty in understanding the nature of the action of language on the mind if we reflect that we do not, any of us, receive it in block all at once, but are each obliged to reconstitute it anew. An apprenticeship takes place which, although it escapes notice and is not recognized even by the one who passes through it, is nevertheless a sort of training school of mankind. Since the best teachers are those who give us the most to do ourselves, what more profitable study can we conceive for the child? What attention is required simply to distinguish the word! We have to disengage it from what precedes and from what follows it; to discriminate between the permanent and the variable elements, and to understand that the permanent element is committed to us to handle in our turn and subject to the same variations. The simplest phrase is an invitation to decompose the thought and see what each word contributes to it. The adjective and the verb are the first abstractions comprehended by the child. Imagine the effort which the ancient languages required even to speak them passably! There was a whole chapter of inner life in it which began again in each person. The people carried within themselves an unwritten grammar, which indeed

slipped into errors and faults, but which nevertheless had a degree of fixedness, for these languages were transmitted from generation to generation for ages. When we consider how much trouble it takes now to learn these languages, we are surprised. But we must recollect that education in the maternal language has the advantage that it is going on all the time and everywhere, that it is stimulated by necessity, that it addresses itself to fresh minds, and that it offers the unique characteristic of associating words with things, and not the words of one language with those of another. The same conditions are in play in all mother tongues, and in all the child's mind achieves a triumph. Our modern languages, while less encumbered with formal apparatus, are still not far from it; and the complication bears upon another point, consisting in the use of words of slight meaning, and so abstract and servile that we never think of them, while we always put them in their proper places. In this we observe intelligence passing to a condition of instinct. This is not through any kind of a notion of the value of the word, but by virtue of a certain number of locutions which memory retains, and which serve as models. Our intelligence derives the same services in daily operations from language that we derive from calculations. In consequence of the infirmity of our understanding, it is easier for us to deal with the signs of ideas than with the ideas themselves. Before the invention of writing, men counted with pebbles. Doubtless this idea must come first; but it is vacillating, fugitive, hard to transmit. Once incorporated into a sign, we are sure we have it, and can direct it at will and communicate it to others. This is the service performed by language; it renders thought objective.

If I had to say in what the superiority of the Indo-European languages consists, I should not seek for it in the grammatical mechanism, or in the compounds, or in the syntax; but in the facility with which those languages, from the most ancient times of which we know, have created abstract nouns. If we observe the suffixes which serve this purpose, we shall be surprised at their number and variety. It is the presence of these nouns in large number, as well as the possibility of making others after the same type, that adapts the Indo-European languages so well to the expression of all the operations of thought.

Accustomed as we are to language, we do not easily conceive of the accumulation of mental labor which it represents; but, to satisfy ourselves concerning it, we have only to take up some book and eliminate all the words which, not corresponding to any objective reality, summarize a mental operation. Hardly anything would be left of the page thus pruned. The peasant who talks of time and seasons, the tradesman who expatiates on his stock of goods, and

the child who brings his certificate of conduct or advancement, move in a world of abstractions. The words *number, form, distance, situation*, are so many mental concepts. Language is a translation of reality, a transposition in which objects figure already generalized and classified by the labor of thought.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

SKETCH OF CARL SEMPER.

CARL SEMPER is characterized by Dr. August Schuberg * as a student who, while being especially thorough in a particular line of research and generally preferring it, was remarkably free from that kind of specialism which is so common and often detrimental to science as a whole. "There are few investigators who have made themselves so familiar with the most various groups of the animal kingdom through their own researches as he; and he most catholicly busied himself with all branches of zoölogy—atomy, histology, embryology, physiology and general biology, systematic biology, and geographical distribution—in all of which he pursued his own lines of investigation, so that it may be said that there are few regions of zoölogy which he did not explore." He was also an industrious student in anthropology and ethnology.

CARL GOTTFRIED SEMPER was born at Altona, July 6, 1832, the son of the manufacturer Johann Carl Semper, and died at Würzburg, May 29, 1893. He attended the gymnasium of his native city till he reached the *Secunda*, and then entered the school for naval cadets which was founded by the "Provisional Government" of Schleswig-Holstein at Kiel in 1848. Not finding the conditions here very attractive, he joined the artillery as a volunteer and engaged in a brief campaign against the Danes. When Schleswig-Holstein was given up to Denmark, he, by his father's advice, attended the Hanover Polytechnic School from 1851 to 1854. At the University of Würzburg (1854 to 1858) he gave special attention to comparative morphology and histology. Having received the degree of Doctor of Philosophy at Würzburg in 1856, he continued his studies there and at the Kiel High School in 1857, and in November of that year started on a tour through Germany, France, and Spain, the object of which, he said, was partly study in the museums and libraries, and partly to find associates who would join him in a more extensive scientific journey. His inten-

* In Arbeiten aus dem Zoologisch-zootomischen Institut in Würzburg, in an article whence the material for this sketch is derived.

tion, in which he was encouraged and assisted by his liberal-minded father, was to visit the Philippine Islands, alone if he should not find suitable companions. In the hope that he might thereby further advance his scientific purposes, as well as in order to gratify his taste for a sea life, he determined to make the voyage on a sailing vessel. Reaching Manila in December 1858, he devoted the first half year of his stay there to making himself acquainted with the country and the people and to mastering the language, and, limiting his zoölogical rambles at first to the neighborhood of the town, did not undertake any more extensive excursion till August, 1859, when he went to the southern part of the Philippines. During a residence of seven months at Zamboanga and on Basilan, in addition to his zoölogical and other scientific researches, he studied the anthropology and ethnology of the Mohammedan Malays living there. Returning to Manila in March, 1860, he began the next month a second long journey to the northeastern part of the island of Luzon, where, besides zoölogical studies, he had an opportunity to become acquainted with the heathen tribes of Malays and collect much new and valuable anthropological and ethnographical material.

His activity was interrupted for several weeks by illness, and, following the advice of a physician, he embarked for the Pelew Islands, where he intended to study the coral formations. His vessel was leaky and unseaworthy, and the voyage was lengthened by the necessity of running in often at the different islands for repairs. His stay at the Pelew group was prolonged for months by delay in putting the vessel in proper condition for the return voyage, and he suffered great hardships, but formed very pleasant relations with the natives; and this, with the richness of the scientific and ethnological treasures he acquired, was ample compensation for all.

Having returned to Manila, he was married to Anna Hermann, of Hamburg, and they soon afterward went to the island of Bohol, north of Mindanao, whence he in the same year (1862) made brief excursions to the neighboring islands of Cebú, Leyte, and Mindanao. The last of the series of expeditions from the Philippine Islands was made to the interior of Mindanao from May till December, 1864; and in May, 1865, Semper left Manila for home.

Near the close of this year Semper was licensed by the Philosophical Faculty of Würzburg as *Privat Docent* in zoölogy. In February, 1869, he was appointed professor extraordinary. Ten days later he became a temporary supply for Professor Leiblein, who was ill, and on Leiblein's death, in August of the same year, he was appointed regular professor and director of the zoölogical cabinet. In 1870 he was invited to go to Göttingen, but decided to remain at Würzburg.

This preference was recognized by the authorities of the university in an assurance that a reorganization of the zoölogical cabinet—the arrangement of which was poorly adapted for purposes of instruction—should be begun, to be completed in five years. Professor Semper proceeded at once with a provisional rearrangement, and with the foundation of a museum of comparative anatomy; and the former zoölogical cabinet was named by the Academical Senate in December, 1871, the Zoölogical Zoötomical Institute. The number of his pupils increased, and many valuable studies were undertaken by them under his lead and at his suggestion; but all their work was hampered by want of means and of space. A site for a building had been granted the university by the city authorities of Würzburg in 1875, but no building money had been appropriated, and the question of the way in which funds could be obtained offered a serious problem.

His work at Würzburg suffered several interruptions. During the war of 1870 his characteristic energy found full sway in the direction of the transportation of provisions and hospital furnishings to the seat of hostilities, in which he was several times engaged. A sojourn in Heligoland in 1873 and 1874, and a visit of a few months in 1876 in company with some of his pupils to the Balearic Islands, were of much advantage to his scientific work. Most important results of his residence in Heligoland were his thorough investigations of the excretory organs of the shark.

In 1877 Professor Semper was invited to deliver the Lowell Institute Lectures in Boston, and improved the opportunity to travel over the western part of our continent. The substance of the twelve Lowell Lectures was afterward embodied in the book, *Animal Life as affected by the Natural Conditions of Existence*, which was published as No. 30 of the *International Scientific Series*, and is characterized by Dr. Schuberg as one of his most important works.

In 1887 Professor Semper suffered a stroke of apoplexy, by which his life was immediately endangered and his vigor was permanently weakened. For a short time he seemed to recover very rapidly, but the evidence of advancing disease which was destined to end in his death became gradually plainer. Still, he would not spare himself, but labored on, as he had done in his younger days, to his injury.

One joy, however, was still to be afforded him. The Bavarian Landtag in 1887 voted money for the erection of a zoölogical institute. He was permitted to have this building constructed according to his own views. It was ready for use in November, 1889, and he was able to enjoy it for a short time; but his health continuing to fail, he was not permitted to carry on the investigations for which it had

been constructed, and was compelled to ask to be relieved of the work of teaching at the end of the year 1892. His successor as director of the institute was appointed at the beginning of the summer semester of 1893, and his own death followed shortly afterward.

The versatility by which Professor Semper was distinguished, and of which we have spoken at the beginning of this sketch, was rarely favored, in Professor Schuberg's view, by his long sojourn in the tropics; for when one is so situated, as he was then, as to be able to spend seven years and a half in the study of the exceedingly diversified and interesting animal forms of luxuriant tropical nature, without being concerned about outside conditions and without having any other duties, he enjoys facilities and is assisted to an extent which few zoölogists can hope for; and he used these opportunities in a manner which attests his extraordinary energy and his capacity to give equal and impartial attention to every branch of his science. His earlier works, before going to the Philippine Islands, and his first researches there were in comparative morphology and histology. As his investigations continued, they were extended to numerous and diversified animal groups, and gave rise to many important discoveries. Of special interest among his publications concerning these researches were his papers on the origin of coral reefs, on the *Trochosphæra*, and on the alternating generations of stone corals. Of special permanent value likewise are his monographs on holothuria and land mollusks. He busied himself, too, with questions of geographical distribution and general biology; and he is credited by Professor Schuberg with having contributed much to the building up of Darwin and Wallace's doctrine of descent, by his efforts to bring some of the questions nearer solution, and by his objective criticisms. Two works are especially mentioned which advanced the discussion of the questions raised by the theory of descent. One of these embodies a series of connected investigations, the results of which go to close a gap which had to be bridged if the theory of descent were to be set upon a stable foundation. Professor Semper, almost simultaneously with the Englishman Balfour, had made the important discovery of the presence of structures in sharks, both embryos and full grown, which attested a conformity of the structure of the urogenital system of vertebrates with that of the annelids; and he believed that he had at last found the bridge which was to be laid from the vertebrate to the invertebrate type. Thus arose, in the building up of the theory based upon this first observation, a series of researches, in which he tried to demonstrate a conformity in structure of the vertebrates and the articulate worms for other organs than the urogenital apparatus, and materially promoted the

solution of extremely important problems of animal morphology, particularly those of segmentation, budding, and strobilation.

Professor Semper did not succeed in obtaining general acceptance of his views on the derivation of vertebrates, but the observations and arguments on the special point, and on general questions, too, set forth in the works relating to them, exercised a remarkably stimulating influence on the further discussion of the problems involved.

The second work in which Professor Semper considered the zoological problems raised by Darwin's theory is the book on *Animal Life as affected by the Natural Conditions of Existence*. The fundamental thought of this book, as defined by the author in his preface, was that, as Jaeger had said, enough had been done in the way of philosophizing by Darwinists, and the task now presented was to apply the test of exact investigation to the hypotheses that had been laid down. Without pretending to have made a complete presentation, his end would be attained if he should have given an impulse to research, on however small a scale, so long as it should be systematically conducted and thoroughly carried out—"if only it should contribute to extend my own conviction as to the uselessness of casual and disconnected observations." The book is described by Dr. Schuberg as a remarkably stimulating one, and no compilation; for, besides permeating and enriching the subject with numerous new thoughts, he incorporated in it a very large number of his own observations, made for the most part during his voyages. Professor Semper further contributed to the literature of zoölogy numerous smaller and special papers, a considerable proportion of which, his own, or composed with the co-operation of his pupils, were published in the *Arbeiten aus dem Zoologisch Institut in Würzburg*. The whole list of his writings, as given by Dr. Schuberg in the biography published in that journal, comprises ninety titles.

Professor Semper contributed also to other fields of literature. His journeys in the Philippine Islands took him into regions rarely visited by Europeans, and of the anthropology and ethnology of which little was known. He included these features within the range of his studies, and was able to cast considerable light upon them. Besides single essays, two works are especially worthy of notice as fruits of his industry in these lines of research—The Philippine Islands and their Inhabitants, which treats of the geographical and ethnological aspects of the group; and The Pelew Islands of the Pacific Ocean, presenting a corresponding view of that still less known region. In 1869 he became one of the editors of the *Archiv für Anthropologie*. Considerable literary value also attaches to his academical lectures.

Professor Semper had a rare art of attaching his students to himself. His manner of meeting and greeting them attracted them. His intercourse with them was friendly and cordial, and was not confined to the hours of instruction. The students of the Würzburg Institute, Dr. Schuberg says, when Professor Semper was in the height of his power as a teacher, constituted a family, of which he was the head. He knew how to pick out the students inclined to independent thought, to draw out their peculiar traits, and to prompt each of them to develop his individuality, or cultivate his habit of independence. Hence, although he had many students, he formed no "school."

A WRITER in the London Spectator, visiting the Zoölogical Gardens in Amsterdam, was much interested in the colony of nesting cormorants on one of the small canals crossing parts of the grounds, where the "domestic side of cormorant life could be seen at close quarters." The birds carried on there their daily work of "fishing, nest-building, sitting on eggs, rearing the young, quarreling for 'stands' for future nests, or basking in the sun within a couple of yards of the path. At the time of the writer's visit there were five nests built close to the water. They were made of large sticks piled to a height of from two feet to three feet. One held a pair of young cormorants, covered with close, black down. In the second were three birds of rather larger growth. On a third nest an old hen bird was still sitting on her eggs, while the cock kept guard on the ground in front. The compact and glossy plumage of both shone with gleams of black and purple luster, set off by the pale yellow skin on the cheek and bill. The cormorant is not usually credited with beauty, but, like the starling, it is a lovely bird in the breeding season, when the sight of the old cock rushing to battle with all intruders, exchanging rapierlike thrusts of the beak with his enemies, croaking, swelling his throat, and even throwing himself on the ground to prevent access to the nest, makes a pretty illustration of bird courage. All this fuss and excitement is confined entirely to the male birds. The hens are quite ready to see a little company when sitting; and two were seen sitting side by side on eggs laid in a joint nest."

CARL VOGT'S publication of his theory of microcephalism caused great offense in certain circles in Germany, and even the children in the streets would sometimes call after him "*Affenvogt*." William Vogt relates in his *Vie d'un Homme* that, desiring to examine a specimen of microcephaly in a strictly closed convent at Eger, Carl took advantage of the doors being opened for General de Gablenz, and attached himself to his party. They were all received cordially and given the freedom of the house. The friar pastor exhibited as the greatest curiosity of the convent "a real man-monkey," a microcephal, which Vogt examined at great length. While he was measuring its angles, the monk exclaimed: "A real man-monkey, isn't it? Wouldn't that pestilent monster of a Carl Vogt be happy if he could see it! I am not malicious, but if he should come within a league of this place he would be lost!"

Editor's Table.

EVOLUTION AND DESIGN.

UPON another page of the present number will be found an interesting article by an eminent Catholic theologian, the Rev. J. A. Zahm, C. S. C., under the title of *Evolution and Teleology*. The point of view which the writer takes up is not one that we can share; but he states his case with candor and ability, and we hold that views so stated are entitled to expression in a periodical which stands, and has always stood, for the freest discussion of all scientific and philosophical questions.

It will be observed that Father Zahm is prepared to make, and very frankly makes, large concessions to modern science. He considers that the doctrine of evolution in its general aspect may be considered as proved. As to what Huxley has called the Miltonic doctrine of creation, he says that "all the conclusions of contemporary science render it not only in the highest degree improbable, but also exhibit it as completely discredited, and as unworthy of the slightest consideration as a working hypothesis to guide the investigator in the study of Nature and Nature's laws." He admits further that, in the light of the Darwinian theory, the reasonings which satisfied our fathers on the subject of design in Nature have become to a large extent obsolete. The authors of the *Bridge-water Treatises*, excellent observers of Nature as they were, regarded the adaptation of a given organism to its environment as the result of direct purposive action on the part of the Creator, entirely analogous to the action whereby a locksmith fits a key to a lock. From the modern point

of view adaptation is simply the necessary condition of existence. Given a geometrical rate of increase in vegetable and animal forms, and the sifting or selective action of the environment will do the rest.

Father Zahm accepts the modern point of view, but does not on that account abandon the idea of design. He quotes certain modern writers, among whom he erroneously includes Huxley, as saying that the teachings of Darwin have simply rendered necessary a restatement of the former argument. Instead of regarding each form of life as miraculously adapted to its environment in the act of creation, we are to consider that the evolutionary process was designed to develop just such forms of life as we now see. A certain Professor Schiller is quoted as maintaining that "once we adopt the evolutionist standpoint, the argument from design is materially and perceptibly strengthened," and that in two ways: positively, by letting us behind the scenes and showing us how effects are produced; and negatively, by removing the necessity for proclaiming everything perfect, seeing that some things, if not all, may properly be considered as only in course of being made perfect. Inasmuch as the view of creation which Huxley, to avoid offense, called Miltonic is really the view which accepts in a plain sense the plain teachings of the book of Genesis, and as that view involves the perfection of all things as they came from the hands of the Creator, who pronounced them "very good," it is evident that Father Zahm adopts a standpoint far in advance of the literalism of popular theology. He recognizes that these matters be-

long to the domain of science, and that scientific investigation can not be arrested by any dictum uttered in the name of purely theological studies or merely traditional opinions.

The main question, however, which his article summons us to consider is whether the doctrine of evolution, which he accepts, lends itself to a teleological interpretation; and upon this point we must say that he, and the authors whom he cites, seem to place their argument on a very unsubstantial foundation. How does the matter stand? There is no question that Nature abounds in examples of what, for want of a more suitable term, we may call adaptation. The eye is "adapted" for seeing, the hand for grasping, the stomach for digesting, and so on. The older naturalists and philosophers, not being able to conceive of any other method by which adaptations could be brought about than that of purposive action, by some power capable of molding the forms of life as the human mechanic shapes the materials in which he works, argued, naturally and reasonably from their point of view, that a special divine power had designedly fashioned each form and each organ so as to fit them for the precise place they were to fill and the work they were to perform in the general economy of things. Paley's argument from a watch was considered irresistible in its day. If, he said, it would be idle to pretend that the parts of a watch, discovered by accident on a common, could have come together of themselves in harmonious correlation, so as to achieve the purpose of correctly measuring time, is it not still more idle to pretend that the vastly more numerous and complex adaptations discoverable in such an organ as the human eye or hand could have been brought about without the aid of an intelligent design-

er? It is true that certain considerations which were obvious enough in Paley's day, and had been so for centuries before, might have suggested a doubt as to whether this argument was conclusive—considerations as to the fashioning process which things undergo by simple contact with their environment, as when a man becomes polished by contact with society, or exposed surfaces hardened to resist the impact of external objects—but, speaking generally, neither the scientific nor the unscientific world was in a position at the time to deny in any effective manner the force of Paley's analogy.

To-day it is different. Father Zahm himself acknowledges that Paley's argument, examined in the light of the doctrine of evolution, becomes untenable. Things were not put together, once for all, by the divine artificer in the way the worthy dean imagined. As Topsy would say, they "grewed" into those conditions of adaptation in which we at present behold them through the combined forces of heredity and natural selection—the former reproducing qualities once spontaneously developed, the latter rejecting forms not fitted to thrive, or at least less fitted than others to thrive, in their actual environment. The question, therefore, at present is, Can we assert with confidence, on the strength of some strong analogy such as that to which Paley—as is now evident erroneously—appealed, that the evolutionary process was set in motion with a distinct intention on the part of an intelligent Creator to produce precisely those forms and modes of life which prevail, and heretofore have prevailed, in the world? Adapted structures, it is conceded, exist, but is it certain that intention or purpose presided over their adaptation? On this question it does not appear to us that either Father Zahm or any of

his philosophical allies shed any light. An argument is attempted to be founded on the fact that the language used by Herbert Spencer himself in dealing with biological questions; but there is nothing in this. Mr. Spencer is not a teleologist; and if he were, we should have to consider his reasons for being one, and not stop short with the fact that he was one. Science does not permit such an abuse to be made of authority. The reason why Mr. Spencer's language and all language has a teleological character is that man has been obliged to frame language on lines prescribed by his own mental activity. Man is essentially a designer, and he reads design more or less into everything that he sees.

There is one passage in our contributor's article which seems to evince that his conversion to the doctrine of evolution is not very complete. He remarks that it is "passing strange that those who are so prompt to deny the existence of purpose in Nature when there is a question of teleology, or when theological implications are suspected, are the very first to insist on the evidence of mind or purpose when in their own case it is demanded by the exigencies of argument or discovery"; and he cites as a case in point the conclusions founded by men of science on the discovery of "arrowheads and flint flakes in certain deposits whose age is indisputable." It is a great pity that Paley is not alive to congratulate Father Zahm on this neat application of his own method. The standpoint here is exactly that of Paley which we were given to understand had been abandoned. Arrowheads are not things that grow. The method of their production is known to us; and it is in the light of experience that we attribute their origin to human agency, and

by the most necessary inference that we form conclusions as to the age of the human race from the situations in which such implements are found. But if, because we are obliged to recognize purpose in the manufacture of an arrowhead, we are equally obliged to recognize it in the first organic form presented to us, what need was there for amending Paley's argument? Our reverend contributor is making the whole work of Darwin of none effect by his traditions; and yet he precluded his argument by a general acceptance of Darwinism. We fear the new scientific baptism has not yet produced its full effect.

So once more we come round to the real point at issue. It is not disputed that evolution produces results which present a resemblance to the products of human design, in so far as the accomplishment of definite results by definite means is concerned; but where is the proof that mind has guided the action of evolution? Where is the proof that the products of evolution to-day are precisely the results that a superintending mind aimed at? Can Divine intention be quoted with any greater certainty in the "adapted" forms which survive than in the unadapted or less adapted ones that perish? We do not say that the teleological view is false; we only say that it requires to support it something more than a mere partial resemblance between the effects of evolution and those of purposive human action. We are far from quarreling with any optimistic creed or any religious interpretation of the universe; but it is right to protest when facts are put to a strain which they are not able to bear, and when consequently a scientific theory is in danger of losing its scientific value.

Our contributor speaks with disapproval of those who find "in the chance interaction of eternal force

and eternal matter an adequate explanation of all the problems of the existing universe." The man who finds in any scientific conception or hypothesis an adequate explanation of all the phenomena of the universe must be a somewhat fatuous being. Certainly this is not the usual attitude of the scientific mind. Mr. Spencer in particular, referred to by our contributor as "the great coryphæus of agnosticism," takes much pains to show that no adequate explanation of the phenomena of the universe is obtainable. What he has labored to do, for his own part, is to formulate the most general laws of world action which it is in his power to discover, and to show how more special methods of action are deducible therefrom. At the very basis of his system lies an unknowable power which does not admit of formulation. If we take the late Professor Huxley as one of the representative minds of the modern scientific world, we shall certainly not find him talking of having discovered an adequate explanation of all existing phenomena. It is one thing to decline the ready-made explanations of others, and quite another to claim to be in possession of a satisfactory explanation of your own. The mission of the man of science is not to explain the world in

its totality, but to give those partial explanations of phenomena and their sequence which are needed to safeguard human life and fructify human effort. The man of science watches over the integrity of his own intellect, and refuses to allow it to be entangled in any yoke of bondage, knowing that he holds his faculty for truth in trust for the world. When he is asked to acknowledge "design" in this or that organism, he says: "I recognize the relations which this thing sustains to its environing conditions, and I have some limited knowledge of its previous course of development; but I do *not* know that it has become what it is through the application to it, or to the conditions under which it was produced, of any stress or influence proceeding from a conscious will such as alone furnishes to my mind the type of purposive action. A conscious will may well underlie this universal frame of things, but I can not, upon grounds of scientific observation, profess to be able to discern the presence or absence of its action at any particular point." This we conceive to be in substance the answer of Science to the question at issue; and it is one with which Theology would do well to be content, for Science will never knowingly make an affirmation which there are not facts to sustain.

Scientific Literature.

SPECIAL BOOKS.

IN no way can one appreciate more clearly the remarkable advance in ethnographic studies than by comparing the great work of Professor Ratzel* on *The History of Mankind* with the early works of Pritchard and Wood. The illustrated work of the Rev. J. G. Wood on the *Natural History of Man* represented the state of our knowledge on the subject at the time it was compiled, in a popular way to be sure, but nevertheless the

* *The History of Mankind*. By Prof. Friedrich Ratzel. Translated by A. J. Butler, M. A. New York: The Macmillan Company. 1867. Two volumes, pp. 486 and pp. 562. Price, \$8.

reader had presented to him in a graphic way a light sketch of the habits, manners, and customs of the various peoples of the world. There were blunders, of course, such as classifying the Japanese with the uncivilized races! In the work of Ratzel we have a popular exposition of the subject from the same standpoint. It is a compact storehouse of facts, and the infinite lines of research shown in this remarkable compilation of data give one a just idea of the tremendous strides the science of ethnology has taken within a quarter of a century. A book bearing the indorsement of Professor Virchow and introduced to English readers by a prefatory chapter from the pen of Dr. E. B. Tylor must be one of importance and merit, and so it is. It has an unusually large number of illustrations of the weapons, utensils, toys, totems, etc., of all the races of the world. The portraits are derived from the very best sources, while maps and brightly colored plates make up a veritable ethnographic museum, and this feature alone renders the book indispensable to American students. Much of the material illustrated is derived from museums which have come into existence within recent times.

The work is so valuable that it seems an ungracious task to point out omissions. It is, however, necessary to call attention to the very evident fact that the author has derived his material almost exclusively from European sources. In that portion of the work dealing with the native races there are but few references to the work of American students. He shows no evidence of ever having seen the magnificent series of volumes issued by the United States Bureau of Ethnology, by far the most important of the General Government's publications. When one recalls the valuable contributions of Mason on the Throwing Stick; Cushing on Zuñi Fetiches; The Sign Language and Petrographs, by Mallery; Mortuary Customs, by Yarrow; Burial Mounds, by Thomas; Central Eskimos, by Boas; Point Barrow Eskimos, by Murdoch; Chiriqui Art in Shell and Pottery and other papers, by Holmes; Pueblo Architecture, by Mindeleff; Masks, Labrets, etc., by Dall; and the contributions by Powell, Stevenson, Henshaw, Matthews, Bourke, Hoffman, Mooney, Turner, Dorsey, McGee, Fewkes, and others which enrich these volumes, and a host of American workers in other lines of investigation, as Morgan, Bandelier, Mrs. Nuttall, Brinton, Culin, and many others, one realizes how clearly Ratzel has restricted himself to the work of European students. It is true many of these memoirs were not published when the first edition of this work appeared in 1884; but when the second German edition was published in 1895 most of these memoirs had appeared and many of them had been widely noticed in European journals, and the lavish generosity of our Government in the distribution of its publications must have placed them on the shelves of every leading library in Europe. The author in several instances confounds Japan with China by including both countries under certain general statements, and in one case the word Japan appears when it should read Java.

There is no evidence that the author recognizes the lowly origin of man. Dealing with the most pregnant facts as to man's evolution, he questions whether the savage is lower than other races considered civilized. For this reason perhaps the early stages of man are not considered, and therefore one must look elsewhere for the evidences of prehistoric man. Not a cranium or a human bone, unless it represents a trophy or a fetich, is given. It is true the work is for the general reader, but nowadays the general

reader, at least in America and England, demands much more than he did twenty years ago.

The work is so full of interesting material that it is impossible in a review of this nature to do more than quote here and there. An illustration of the persistence of certain traits in man is shown in the Tedas or Tebus, which are supposed to be the Troglodytes described by Herodotus. "They are to-day no poorer, no richer, no wiser, no more ignorant than they have been these thousands of years; they have acquired nothing in addition to what they possessed then." He shows in contrast the Europeans emerging from savagery in an exalted place among the peoples of the world. By such a picture do we see the persistence of conditions identical in every respect to those of the animals below us. While a form of Brachiopod may persist nearly unchanged from the lowest geological horizons to the present day, other forms of life may pass through rapid changes and become extinct. A group may go through slow and even changes like the ammonites of the Jura and finally culminate in rapid and extraordinary modifications in form.

In contrasting the inertness of the Chinese with the progressive European nations, he quotes Voltaire as "hitting the point" when he says that "Nature has given the Chinese the organs for discovering all that is useful to them but not for going any further." Peschel presents these contrasts in a clearer way perhaps when he says: "Of all highly civilized nations the Chinese owe least to foreign promptings, whereas until the thirteenth century we—that is to say the Europeans, and especially the northern Europeans—owed almost everything but our language to the teaching of other nations. . . . Since our intellectual awakening, since we have come forward as the propagators of the treasures of culture, we have indefatigably toiled with the sweat of our brows in search of something, the very existence of which was unsuspected by the Chinese, and which they would think dear at a platter of rice. This invisible object we term causality. We have admired the Chinese for an incalculable number of inventions and have appropriated them, but we are not indebted to them for a single theory or a single glance into the connection or the first causes of phenomena."

The statement is made that Chinese ships are said to have been cast away on the northwest coast of America. In every case the junks which have been cast away on our western coast or found drifting in the North Pacific are Japanese junks, not Chinese. A reference is made to glazed tiles associated with ancient pottery having been exhumed in the Mississippi Valley near Natchez. As a matter of fact the tile is post-Columbian.

The arrangement of cuts is somewhat confusing; they are not always found with the text. As the cuts are not numbered, there is no way of referring to them in the text. On the other hand, a good legend accompanies each illustration, and usually full credit is given to its derivation. References to special works on the subject treated would have added greatly to the value of the book. Thus on page 287, Volume II, the author says in speaking of the Hottentots: "If we may believe Kolb, the fortunate hunter undergoes an 'alterative process' at the hands of some old fellow-tribesman in the form of a hydraulic application which does not bear more minute description." Is he referring to Peter Kolben's remarkable work on the Present State of the Cape of Good Hope, an English translation of which

was published in 1731? A reference to Kolben's work would have given the student access to material which depicts the Hottentot before he had been seriously contaminated by contact with intrusive races, and would have explained the curious ceremonies connected with marriage and other rites and functions.

In regard to the dwarf tribes of Africa he says: "It is a pity that Stanley . . . has shown his usual tendency to exaggeration. With the dwarfs he has jumbled up children or misshapen beings such as negro chiefs keep at their courts for entertainment." Among the interesting generalizations is this one: "It has been correctly said that among negroes as elsewhere morality seems to stand in inverse ratio to the quantity of clothing, so that tribes that go naked are, so long as they remain untouched by foreign influence, the most chaste; those that are most clothed the least so." The missionaries can not or will not see the significance of this truth, and instantly demand a sudden change in habits engendered under a tropical sun, with the inevitable result of physical and moral degeneration of their converts.

His treatment of the African races is by far the most exhaustive, and the mass of new material in statement and in illustration will be of the greatest value to the American student.

GENERAL NOTICES.

THE important question of memory and its cultivation is the subject of the last volume in the International Scientific Series to reach us.* What memory is, its place and importance in the economy of the human mind, its divisions and special functions, and, finally, methods for its cultivation, is the ground covered by Mr. Green's book. The great importance of a good memory is manifest; in fact, our intelligence depends almost entirely on the ability to remember what we learn, or, more accurately, what we perceive, as learning a thing implies the use of memory, so that any suggestions which may help to improve our ability to remember are worthy of close attention. Mr. Green says that in his own case, after a use of the methods he recommends, he found that he could learn a subject in about a fifth of the time that it previously took him. The special rules for memory cultivation occupy only the last fifty-five pages, although the whole subject is treated with special reference to this aspect of the question. The rules are simple, and, in fact, those which common sense would dictate—such as concentration of attention on the subject which it is desired to remem-

ber; the exclusion of unimportant and confusing details; frequent recalling of the impression; the use of as many faculties as possible in fixing the original impression; studying when the nervous force is abundant, etc.

When the political uncertainties of the scientific departments at Washington are considered, it seems really remarkable that anything at all is accomplished by them. For the successful prosecution of original research freedom from the petty cares of political maneuvering would seem essential, and yet some of these sections, notably the ethnological and geological, are constantly turning out valuable material. The last of their publications to reach us are a number of Geological Survey bulletins.* The first one, No. 87, is by Charles Schuchert, and gives a synopsis of the American Fossil Brachiopoda, including a valuable bibliography and synonymy. The richness of North America in well-preserved Palæozoic brachiopods gives Mr. Schuchert's work a special interest. No. 127, by N. H. Darton, is a catalogue and index of contributions to American geology, and while there can be little said of it in the

* *Memory and its Cultivation.* By F. W. Edridge-Green. New York: D. Appleton and Company. Pp. 307. Price, \$1.50.

* Department of the Interior. Recent Bulletins of the United States Geological Survey. Nos. 87, 127, 128, 139, 140, 141, 142, 144, 145, 146.

way of a review, the value of a carefully prepared bibliography of geological literature as a reference book for libraries and geological writers can not be overestimated. No. 138 is entitled *Artesian Well Prospects in the Atlantic Coastal Plain Region*, and is by the same author as No. 127. It seems that in this region of the Atlantic slope there are no large supplies of potable surface water. Fortunately, however, it has a geologic structure particularly favorable to the accumulation and flowage of underground waters, and from these underground streams several cities at present obtain their water supply. Mr. Darton tells us that during the past six years he has been engaged in a geological study of this coastal plain region, and has given especial attention to the question of subterranean waters; and while this investigation is as yet very imperfect, he thinks that it will in a measure meet the great demand for information as to well prospects and the general relation of the water horizons. In No. 139 Messrs. Weed and Pirsson give us a general study of the geology of the Castle Mountain mining district of Montana. No. 140 is a report of the progress made in the division of hydrography in the calendar year of 1895. The author is F. H. Newell. The Eocene Deposits of the Middle Atlantic Slope in Delaware, Maryland, and Virginia, A Brief Contribution to the Geology and Paleontology of Northwestern Louisiana, The Moraines of the Missouri Coteau and their Attendant Deposits, and The Potomac Formation in Virginia are the titles of the next four bulletins. No. 146, by F. B. Weeks, is a Bibliography of North American Geology, Paleontology, and Petrology and Mineralogy for 1895. No. 147 is a record, by C. D. Perrine, of the earthquakes occurring in California in 1895, of which there seem to have been about fifty. Messrs. Clarke and Hillebrand, in No. 148, publish some analyses of rocks and analytical methods used in the United States Geological Survey between the years 1880 and 1896.

In *The Social Mind and Education*,* by G. E. Vincent, an effort is made to bring conceptions from social philosophy to bear

upon the problem of education, with the hope that there may result both clarification of ideas and greater definiteness of purpose. Stress is laid chiefly upon the cognitive function of society and of the individual. Such one-sidedness of treatment is adopted, not from any failure to recognize the organic unity of the mind, but because the vastness of the general subject precludes its treatment in a single volume. The parallel between the development of the race and the individual has of late been subjected to criticism. "It has been pointed out that there are short cuts by which in individual evolution whole stages of the race's growth may be omitted. . . . Education sets before itself the task of relating the individual intrinsically to the social tradition so that he may become an organic part of society. . . . It should be therefore a definite aim of the higher education to direct the student in a purposeful integration of his various pursuits, a putting back of these abstractions into a concrete conception of life."

Dr. Shufeldt has at last brought together in one volume* the majority of his popular scientific papers on *Natural History*. Most of the material has already appeared as magazine articles, and hence does not form a systematic treatise, but is rather a series of Nature stories selected at random, and ranging from the cedar bird to the polar bear. Technical descriptions are avoided, and the text has been prepared chiefly with the view of stimulating the unscientific to an interest in the common forms of animal life which are so abundant and interesting, and which usually receive so little intelligent attention from the average country stroller. The first two chapters deal with methods of study and the classification of animals, and serve as a sort of introduction to the main portion of the book. There is also a final chapter on museums and their uses. This class of books on popular natural history has been enormously increased of late, and while even the poorest of them have some value, a new one in order to justify itself ought to have special claims to originality, and in order to be of scientific value, some system in

* *The Social Mind and Education*. By George Edgar Vincent. New York: The Macmillan Company. Pp. 155. Price, \$1.25.

* Chapters on the *Natural History of the United States*. By R. W. Shufeldt. Illustrated. New York: Studer Brothers. Pp. 472.

its treatment of the various groups. This volume is unfortunately devoid of the latter qualification, but does contain a number of reproductions from actual photographs of the living forms; some of them actually very good and others very bad, but all of them remarkably good when one considers the great difficulties in the way of photographing the living animal in its native woods. These pictures and Dr. Shufeldt's facility in presenting scientific facts in a readable and entertaining form no doubt help to justify the book.

The State Geologist of Indiana, *W. S. Blatchley*, informs us, in his *Twenty-first Annual Report of the Department of Geology and Natural Resources*, that abandoning, for the most part, "the unscientific method of county surveys, which is impeded by artificial boundaries having no relation to geological conditions," he has adopted that of taking up each of the great natural resources of the State, and preparing a monograph thereon, based upon actual field investigation. The present report contains papers by him and his assistants upon the natural resources of the State, the petroleum industry, composition of coals, the Black Slate or Genesee Shale of New Albany, Indiana Caves and their Fauna (finely illustrated), the Geology of the Middle and Upper Silurian Rocks of Clark, Jefferson, and neighboring counties, the Bedford Oolitic limestone (the famous building stone), natural gas, mines, oils, the geology of Vigo County, and the uncultivated ferns, fern allies, and flowering plants of the same county. The report is illustrated by maps and plates.

A lecture on *The Protestant Faith, or Salvation by Belief*, read on various occasions before the Young Men's Christian Union by *Dwight Hinckley Olmstead*, is published by G. P. Putnam's Sons, with an introduction on the Limitations of Thought. It is a criticism of the Protestant principle of freedom in thought, and maintains that belief is involuntary, and therefore compulsory.

In preparing the second edition of his book on *The Psychological Correlation of Religious Emotion and Sexual Desire*, the author, Dr. *James Weir*, has incorporated in it a considerable amount of additional evidence in support of his theory, has verified all ref-

erences, has endeavored to eliminate unnecessary material, and has divided the work into three parts. He has also added to the volume several other essays in which psychological problems are considered. Of the main work, the first part relates to the origin of religious feeling, which is believed to have been first material and prompting to propitiatory offerings. The second part is devoted to Phallic Worship, which, the author argues, dates from a very early period, has been universal, and has survived, even in some parts of Europe, in one form or another, to a very recent period; and the general subject, as defined in the title of the book, is treated in the third part. Dr. Weir's theory was first announced in a medical journal in New York in 1894; the first edition of this book was printed in June, 1897, and the second edition was all written and in the hands of the publishers in August, 1897—all before another book on the same subject appeared, in October, 1897.

The King's Daughter and the King's Son, "a fairy tale of to-day," by *Agatha Archer*, was written, as we learn from the title-page, by a King's Daughter in the summer of 1896. It declares its part to be "to conspire with the new works of new days." It presents subjects of vital social relations from a new point of view, and aims to enforce the precept that women should be given time and opportunity before marriage to understand clearly what marriage means to them. (Fowler & Wells Company, publishers. Price, \$1.)

Physical Problems and their Solutions, by *A. Bourgougnon* (D. Van Nostrand Company's Science Series), presents a number of problems classified under the headings corresponding to the different divisions of physics to which they are related, and prefaced by such explanations as render their meaning clearer; also problems which have been set at examinations by the University of the State of New York. The solutions of some of the problems are given, and in cases where similar problems have already been treated, references to such solutions have been made.

The author, *D. K. Tenney*, of a paper entitled *The Cooling Universe Refuted: the Earth not Born of the Sun*, aiming to awaken inquiry on the subjects treated of, seeks to

show that current theories of the origin and history of the earth and solar system are wrong; that the sun does not project light and heat as such to the earth; that the earth is not a result of nebular evolution, but is self-existent and independent, as are other planets and systems, and along with the other bodies is a great electro-magnet; and that the forces of that category developed by these bodies are the power behind all phenomena. His argument consists of variations of the familiar one that the present explanations—accepted for want of better ones—are unsatisfactory. His electro-magnetic idea—perhaps not intrinsically objectionable as a general principle—still leaves the why and the how unaccounted for.

A book by Dr. *Frank Wood Haveland* (published by the author, 205 West 118th Street, New York, \$2), entitled *Science, the Ancient Hebrew Significance of the Book of Genesis*, is a little bewildering to one not initiated into the mysteries of Christian science. The book of Genesis is described as the foundation of all other books of the Bible and of every science, philosophy, and religion of all ages, and as explaining various biblical and human mysteries, including the science of healing of the sick, and revealing the highest conditions of thought. In connection with the authorized version of Genesis, a paraphrase is published, embodying its supposed hidden meaning.

The poem of *Josiah Augustus Seitz*, entitled *The Colloquy*, is further designated on the title-page as Conversations about the Order of Things and Final Good, held in the Chapel of the Blessed St. John, summarized in Verse. The conversations cover a considerable part of the field of philosophy and knowledge, and relate to subjects, some of which, as in the tenth conversation, "The World of Wrong and Pain," bearing on the social aspects of life; the twelfth, "Of the Natural Order," setting forth evolution; and the thirteenth, "Excursion to Mars," relating to cosmogony, bear on subjects coming within the purview of science. (G. P. Putnam's Sons. Price, \$1.75.)

Certain underground structures found in some of the ruined groups of Yucatan have excited the curious attention of explorers, but have not been satisfactorily accounted

for. They are generally single chambers, resembling vaults in appearance, built ten or fifteen feet below the surface, and having no connection with the outer world except a single opening through the roof. They are particularly noticeable at Labná, and several have been found at Uxmal. Thirty-three of these *chultunes*, as they are called, at Labná have been explored by Mr. *Edward H. Thompson*, whose report upon them, *The Chultunes of Labná*, is published as a Memoir of the Peabody Museum of Ethnology and Archaeology. Mr. Thompson found in them much dust, flint implements, potteries, and human bones. He believes that they were primarily built and used for the storage of water in a region where that necessary is very scarce and hard to get, and that some of them were afterward converted into tombs.

Suggestions for laboratory and field work in *High-School Geology*, by *Ralph S. Tarr*, is intended as an aid for the teacher. It is an attempt to introduce the object-lesson method into the study of geology, and, while there can be no question of its desirability and efficacy, there are many difficulties in the way of its adoption in the ordinary high school, the chief among which are lack of time and adequate knowledge by the teacher. The subject is taken up chapter by chapter (following the author's *Elementary Geology*), field and laboratory work being introduced wherever it seems called for. The latter half of the volume consists of a series of questions for use with the author's *Elementary Geology*. (Macmillan, 25 cents.)

The elementary course in comparative anatomy of the vertebrates includes, in many colleges, the thorough study of some readily obtained, characteristic vertebrate, followed by studies of the various types. Prof. *David S. Kellicott*, of the Ohio State University, finds that in the preparation of literary guides for these dissections, the Ophidian, or snake, has been omitted. Considering it as really an important and agreeable type, and easily obtained in the spring, he has undertaken to supply the omission with a little handbook on the *Dissection of the Ophidian*. The Spreading Viper (*Heterodon platyrhinus*), a common, harmless snake of fair size, is taken as the type for examina-

tion. The systematic place and external characteristics of the *Ophidia* are first explained, and then follow chapters on bones, muscles, and the digestive and vascular systems and special sense organs, and brief explanations of methods are given in appendixes. (Published by the author, Columbus, Ohio.)

Another of Appletons' Home-Reading Books is *Harold's First Discoveries*, in the Nature-Study series, by J. W. Troeger, designed for younger children. Harold observes what he sees, or at times goes out to see, and learns or is told about the dispersion of seeds like those of the milkweed, dandelion, thistle, etc., trees, fruits, vapor, frost, the magnet, metals, crystals, animal life, and budding and germination as illustrated in the willow, lilac, beans, and peas. The works in these series are furnished with practical hints as to the way the subjects may be dealt with in the teachers' guidance of their pupils, so as to awaken the most lively interest and contribute to real knowledge of them.

An account of *Certain Aboriginal Mounds of the Georgia Coast*, published by Clarence B. Moore in the Journal of the Academy of Sciences of Philadelphia, gives the result of five months' continuous work in the mounds along the coasts of the inland water passage, in the course of which twenty-one of them were examined. Remarks on the methods of burial observed in these mounds and in those of Florida—"bunched" and "flexed"—the burial of infants and burials in baskets and in jars, precede the accounts; attention is called to some rather marked differences in custom and practice found to have prevailed in the region and in Florida, and even in close neighborhood with one another. A chapter is added on Inhumation and Incineration in Europe, by the Marquis de Nadaillac. The paper is illustrated by figures in the text and fifteen excellent large plates.

Dr. M. L. Holbrook is of the opinion that "the time has come for man to take special interest in his own evolution, to study and apply so far as possible all the factors which will in any way promote race improvement." As a contribution to this study he offers his book on *Stirpiculture* (M. L. Holbrook & Co., New York, \$1). We are not yet able, he

admits, to apply perfectly all the factors that will promote race improvement, but we can make a beginning; "greater thoughtfulness may be given to suitable marriages; improved environment may be secured; better hygienic conditions taken advantage of; food may be improved; the knowledge we have gained in improving animals and plants, so far as applicable, may aid us; air, exercise, water, employment, social conditions, wealth and poverty, parental conditions, all have an influence on offspring, and man should be able to make them all tell to the advantage of future generations." These topics are discussed in so far as they bear upon the main question.

Mrs. L. L. W. Wilson's manual for teachers on *Nature Study in Elementary Schools* (the Macmillan Company, New York, 90 cents) is characterized by the editor, Francis W. Parker, as "an outgrowth of a rich, varied, and thoughtful experience with child nature and the nature that surrounds the child." The manner and atmosphere of the book justify the characterization. The method has been tested in the schoolroom with excellent results. It is planned to meet the needs of the ordinary grade teacher in the public schools of a city. It does not presuppose special knowledge on the part of the teacher, or special facilities for the collection of material, but earnestness in his work and all that pertains to it. The system is substantially an object-lesson system, and should be assisted by class excursions for material. The excursions of the author's class were made into the street, in Philadelphia.

To their valuable and attractive series of Home Reading Books, Messrs. D. Appleton and Company have added *The Hall of Shells* (price, 60 cents), in which the young reader is introduced by the author, Mrs. A. S. Hardy, to the beauty and wonderful structure of mollusks and the habitations they construct for themselves. The characters in a simple story wander along the seashore gathering shells, or find them in their aquarium and converse freely about them—their forms, colors, peculiarities of structure, and the animals that inhabit them—under the guidance of one who has some scientific knowledge of them. In this way enough informa-

tion is brought in to give a fair degree of general knowledge concerning the animals or families under study, and the reader is referred for further facts to accessible works which give them. Thus the reader is taught concerning the more common shells, the mythologies and literature concerning them, their microscopic structure, pearls, seaweed, the nautilus, the Medusa, echinoderms, the Gordoniadæ, the work of mollusks, the fate of shells, the use of the drag-net, etc.

Another, a little larger book of the Home-Reading Series, is *Uncle Sam's Secrets* (75 cents), the purpose of which is defined by the author, *Oscar Phelps Austin*, "to be to furnish the youth of the land some facts about the affairs of the nation, and to awaken in the mind of the reader an interest in kindred subjects." In this book, too, a thin thread of a story and the conversations of the characters in it are made the vehicle for conveying instruction about different kinds of Government money, the postal service, American geology, the mint, the courts, the navy, bimetalism and monometallism, the history of the currency, the

tariff question, the history of parties, and the presidential electoral system. Copious references are made to the books in which further information on those subjects may be found.

Among the great variety of information on the special subject given by the *Scovill and Adams Company* in their *American Annual of Photography and Photographic Times Almanac* for 1898 (price, 75 cents), we single out for mention the contributed articles conveying instruction as to methods and processes or relating experiments and experiences—the chemical tables, the descriptions of the novelties of the year, the standard formulas and useful recipes, tables for the simplification of emulsion calculations, tables of comparative light values, the list of principal chemicals, photographic schools, list of photographic books published in 1897, the record of photographic patents, lists of American and foreign photographic societies, and a list of hotels having dark rooms for development. Numerous plates and pictures represent photographic work of rare excellence, or illustrate the text.

PUBLICATIONS RECEIVED.

Agricultural Experiment Stations. Bulletins and Reports. New Hampshire College, Durham: No. 47. Strawberries. By F. W. Rane. Pp. 24.—New Jersey: No. 126. Small Fruits. By Alva T. Jordan. Pp. 82; Bovine Abortion, Milk Fever, and Garget. By Julius Nelson. Pp. 24.—New York: No. 130. Popular edition. A New Disease of Sweet Corn. Pp. 5; No. 131. Popular edition. Oat Smut and New Preventives. Pp. 6; No. 132. Popular edition. Milk Fat from Fat-Free Food. Pp. 6. All by F. H. Hall.—Ohio: Newspaper Bulletin. No. 180. The Sugar-Beet Tests of 1898. Pp. 1.—United States Department of Agriculture, Weather Bureau: An Improved Sunshine Recorder. By D. T. Marling. Pp. 15.

American Academy of Political and Social Science. The Economic Relation of Life Insurance to Society and State. Addresses by various persons at the meeting, December 17, 1897, Philadelphia. Pp. 48. 25 cents.

Bailey, L. H., and others. Garden Making. Suggestions for the Utilization of Home Grounds. New York: The Macmillan Company. Pp. 417. \$1.

Bulletins, Proceedings, and Reports. American Microscopical Society. Transactions, Twentieth Annual Meeting, August, 1897. Pp. 209.—American Railway Association. Meeting of October, 1897. Pp. 106.—American Society of Naturalists. Records, Vol. II, Part II. Providence, R. I. Pp. 47.—Argentina: Anales de la Oficina Meteorologica (Annals of the Meteorological Office), Vol. XI. Walter G. Davis, Director, Buenos Aires. Pp. 502.—Blue Hill Meteorological Observatory. The Highest Kite Ascensions in 1897. By S. P. Ferguson. Pp. 21.—City of Springfield, Mass.: Report of the Superintendent of Schools (advanced notes) for 1897. Thomas M. Balliet, Superintendent.—

Linnæan Society of New York. Abstract of Proceedings for 1896-'97; with the fishes of the Fresh and Brackish Waters in the Vicinity of New York City. By Eugene Smith. Pp. 56.

Clerke, Agnes M., Fowler, A., and Gore, J. Ellard. Astronomy. (The Concise Knowledge Library.) New York: D. Appleton and Company. Pp. 561. \$2.

Elmer, Th. On Orthogenesis and the Importance of Natural Selection in Species Formation. Chicago: Open Court Company (Religion of Science Library). Pp. 58. 25 cents.

Frankland, Percy, and Mrs. Percy. Pasteur. New York: The Macmillan Company. (Century Science Series.) Pp. 224. \$1.25.

Hittell, Theodore H. History of California. Notice of the third and fourth volumes. Pp. 15.

Jones, Harry C. The Freezing-point, Boiling-point, and Conductivity Methods. Easton, Pa.: The Chemical Publishing Company. Pp. 64. 75 cents.

Kremers, Edward, Editor. Pharmaceutical Archives. Vol. I, No. 1, January, 1898. Monthly. Office of the Pharmaceutical Review. Milwaukee, Wis. Pp. 24, with plates. \$1 a year.

Ladd, Prof. George Trumbull. Outlines of Descriptive Psychology. A Text-Book of Mental Science for Colleges and Normal Schools. New York: Charles Scribner's Sons. Pp. 423. \$1.50.

Merriam, Florence A. Birds of Village and Field. A Bird Book for Beginners. Houghton, Mifflin & Co. Pp. 406. \$2.

Noyes, Arthur A., and Mulliken, Samuel P. Laboratory Experiments on the Class Reactions and Identification of Organic Substances. Easton,

Pa.: Chemical Publishing Company. Pp. 28. 50 cents.

Parker, T. Jeffery, and Haswell, William A. A Text-Book of Zoology. New York: The Macmillan Company. Two volumes. Pp. 779 and 683. \$9.

Reprints. Blackford, C. M., Atlanta, Ga.: A Method of Teaching Histology. Pp. 8.—Dellenbaugh, F. S.: The True Route of Coronado's March. Pp. 36.—Evermann, B. W.: Notes on Fishes collected by E. W. Nelson on the Tres Marias Islands and in Sinaloa and Jalisco, Mexico. Pp. 8.—Galloway, D. H., M. D., Chicago: What We Eat and What it Costs. Pp. 7.—Marlatt, C. L.: A Brief Historical Survey of the Science of Entomology, etc. (President's Address, Entomological Society of Washington). Pp. 40.—Von Schrenk, Hermann. The Trees of St. Louis as influenced by the Tornado of 1896. Pp. 16, with plates.

Scripture, E. W., Editor. Studies from the Yale Psychological Laboratory. Vol. IV, 1896. Pp. 141. \$1.

Smithsonian Institution Publications: Report of S. P. Langley, Secretary. Pp. 89.—The Astaciæ of the United States, etc. By Walter Paxton. Pp. 52.—Bibliography of the Metals of the Platinum Group, 1798-1896. By James Lewis Howe. Pp. 320.—Supplement to the Annotated Catalogue

of the Published Writings of Charles Abiathar White, 1838-1897. By T. W. Stanton. Pp. 16.—Contributions to Philippine Ornithology. By Dean C. Worcester and Frank S. Bourns. Pp. 80.

Stickney, A. B. The Currency Problems of the United States in 1897-'98. Pp. 32.

Titchener, E. B. A Primer of Psychology. New York: The Macmillan Company. Pp. 814. \$1.

United States Commission of Fish and Fisheries. Publications available for Distribution on June 30, 1897. Pp. 16.—Records of Observations made on Board the United States Fish Commission Steamer Albatross, during the Year ending June 30, 1896. Pp. 32.—Notes on the Halibut Fishery of the Northwest Coast in 1896. By A. B. Alexander. Pp. 4.—Descriptions of New or Little-known Genera and Species of Fishes from the United States. By Barton W. Evermann and William C. Kendall. Pp. 8, with plates.—Observations upon the Herring and Herring Fisheries of the Northeast Coast, with Special Reference to the Vicinity of Passamaquoddy Bay. By H. F. Moore. Pp. 54, with maps.—The Salmon Fishery of Penobscot Bay and River in 1895 and 1896. By Hugh M. Smith. Pp. 12, with plate.

Ward, Lester F. Outlines of Sociology. New York: The Macmillan Company. Pp. 301. \$2.

Fragments of Science.

The Origin of Coral Island Forms.—

This much-discussed question has been raised again by the boring operation of Professors Sollas and David at the island of Funifuti. Their results, as far as they have been announced, seem to confirm Darwin's theory of subsidence. But now we have a letter (American Journal of Science, February, 1898) from Alexander Agassiz, who is at present with a scientific expedition in the Fiji Islands, announcing observations which seem to point toward elevation rather than subsidence. Professor David's bore hole at Funifuti was carried down six hundred and ninety feet, and a preliminary examination of the core indicated that the reef had been built up in the immediate neighborhood, at any rate, of growing coral. Portions of true reef were found in various positions throughout the whole depth. There seems, however, to be a possibility that the boring was situated on a very steep slope of volcanic rock, covered by a talus of coral *débris* from a reef on the summit. A further and fuller report from Professor David will no doubt clear up some of these uncertainties. The material received from Mr. Agassiz is only that contained in a private letter. Much to his own surprise, he found the general appearance of the islands to indicate,

if not prove, that elevation rather than subsidence had taken place. After recalling Professor Dana's statement of the beautiful illustration which the Fijis gave of the gradual changes brought about by subsidence, he says: "My surprise was great, therefore, to find within a mile from Suva an elevated reef about fifty feet thick and a hundred and twenty feet above the level of the sea, the base of the reef being underlaid by what is locally called soapstone, probably a kind of stratified volcanic mud." Many other traces of extensive elevation were noted. At Tarutha, for instance, the coral limestone bluffs were probably eight hundred feet high. From a series of such observations Mr. Agassiz "is inclined to think that the corals of to-day have actually played no part in the shaping of the circular or irregular atolls scattered among the Fiji Islands; furthermore, that they have had nothing to do in our time with the building up of the barrier reefs surrounding either wholly or in part some of the islands. I also believe that their modifying influence has been entirely limited in the present epoch to the formation of fringing reefs, and that the recent corals living upon the reefs, either of the atolls or of the barriers, form only a crust of very moderate thickness upon the underlying base.

This base may be either a flat of an eroded elevated reef or of a similar substructure of volcanic rocks, the nature of that base depending absolutely upon its character when elevated in a former period to a greater height than it now occupies. . . . The Fijis are not situated, as was supposed, in an area of subsidence, but on the contrary, they are in an area of elevation, so that the theory of Darwin and Dana is not applicable to the islands and atolls of the Fiji group." As it was a study of these and similar groups which led Darwin and Dana to adopt their theory of subsidence, Mr. Agassiz seems to dispose of the theory as applied to any islands, although he says in a later paragraph, "The great variety of causes which have been active in shaping the present physiognomy of the reefs and atolls of Fiji shows the impossibility of assigning any one factor . . . as the single cause for the formation of the many different kinds of atolls and barrier-reef islands to be found in the Fiji group." Mr. Agassiz promises a fully illustrated report some time during the coming summer.

New Theories regarding the Rainbow.—

The old theory of the rainbow, which is still found in optical text-books, only imperfectly accounts for the true bow and fails entirely to explain the "spurious bows" which often accompany the former. It is usually possible by close examination to distinguish certain colors on the inside edge of the primary which are not consistent with the simple series of spectrum colors, accounted for by the Descartes theory. In a paper on *The Intensity of Light in the Neighborhood of a Caustic*, Airy seems to have laid the foundation for an adequate theory of the rainbow. An article in *Nature* on this subject says that Mr. J. M. Pernter is working out the new theory, and his general conclusions are given as follows: "The greater the drops the more spurious bows." A chief bow of intense pink and green (hardly any blue) indicates drops of diameters ranging from one to two millimetres; intense red always speaks for big drops. Secondaries (spurious bows) of green and violet (the blue is marked by contrast) without yellow, immediately forming the chief bow, correspond to drops of 0.5 millimetre, while five and more secondaries with-

out white and without breaks mark drops of 0.1 millimetre. A partly white bow is produced by drops of 0.06 millimetre, and when the drops are still smaller, a real white bow with orange-yellow and blue margins is the result. The net result of these elaborate investigations will be to add a new interest to a natural phenomenon already endowed with many associations of magic and beauty."

The Recent Total Eclipse of the Sun.—

While there have been no complete reports from any of the observation parties of the total eclipse of the sun of Saturday, January 22, 1898, enough information has been received to indicate that the majority of them were successful and that much data of extreme scientific value has been obtained. The only district in which the weather was not propitious seems to have been southern Russia, only a few good photographs being obtained. A telegram received from the Rev. J. M. Bacon, in charge of the British Astronomical Association at Buxar, announces perfect weather and "observations satisfactory all round." This party is reported to have taken a successful series of cinematograph pictures. The party located at Jeur, from the Lick Observatory, under the direction of Prof. W. D. Campbell, reports very successful observations. The unusually favorable weather, the number of trained observers on the ground, and the delicate and powerful instruments at hand, have evidently combined to make this one of the most important scientific events in the closing years of the century. In calling attention to this fact Nature says: "With such a list of successes we may safely say that this eclipse, as befitting the last one of the century, has surpassed all previous records; but, unlike many eclipses at the beginning of the century, it can not be truly said that the event of Saturday was over at the end of two minutes of totality. To many the eclipse has yet to begin and will last for many months, during which time each line in the spectrum, each streamer of the corona, each prominence on the sun, will be analyzed little by little to discover if we have similar streamers in other coronas or identical lines in our laboratories. It may be confidently expected that the results obtained

on Saturday will enable us to solve some of the enigmas of solar phenomena and constitution."

Source of the X Rays.—Professor Trowbridge, of Cambridge, and J. E. Burbank have recently published (American Journal of Science, February, 1898) the results of an investigation into the source of the X rays. The experiments were conducted with Crookes tubes containing no interval between the anode and cathode, so that no discharge in the usual sense occurred in the tubes. A continuous conductor was led through the rarefied tube, and it was discovered that X rays were given off from every element of this conductor at right angles to its surface when a disruptive discharge occurred in the circuit of which the tube formed a part. This remarkable result was obtained by means of the very high electromotive force from a Planté rheostatic machine which was charged by ten thousand storage cells. Among the interesting data obtained were some regarding the so-called X-ray burn. When the back of the hand was exposed to the brush discharge from one of these tubes, a peculiar pricking sensation was experienced and all the symptoms of an X-ray burn developed. The skin when examined under a microscope exhibited centers of inflammation surrounded by regions of lesser degrees of burn. It thus seems evident that the so-called X-ray burn is due to an electrification—a discharge at the surface of the skin—and this electrification may or may not be accompanied by the X rays. The results of the experiments are summed up as follows: 1. A Crookes tube inclosing a continuous conductor is well suited, with the employment of high electromotive force, for the study of electric lines of induction. 2. The direction of the so-called X rays and cathode rays can be changed by electric induction. 3. The so-called X-ray burn can be produced by an intense state of electrification. 4. The so-called cathode rays and X rays are given off from every element of a continuous conductor at a high stage of the vacuum in a Crookes tube, both when this conductor constitutes the cathode and when it forms the anode of the electrical circuit. The term electric rays, possibly rays of polarization, would appear to be

more comprehensive than the terms cathode rays and X rays.

Early Observations of the Zodiacal Light.

—Apparently the earliest mention of the zodiacal light is a notice by Diodorus Siculus, of the appearance in the sky, in B. C. 373, "of a great light for several nights, which was called, from its shape, the burning beam." Nicephorus, in his Ecclesiastical History, tells of a remarkable appearance in the sky for a considerable time during the summer and fall of A. D. 410, which he thought could not be a comet, because it had not a stellar nucleus. Cassini saw a similar phenomenon in March, 1668, and his nephew Maraldi another in March, 1702; but Cassini's observation was of a comet, the head of which was not visible to him, while it was seen in the East Indies and at the Cape of Good Hope. The first person to give a definite description of the zodiacal light was Joshua Childrey, who is quoted by W. T. Lynn in the Observatory as saying that "in February, and for a little time before, and a little after, that month (as I have observed several years together), when the Twilight hath almost deserted the *Horizon*, you shall see a plainly discernible ray of the Twilight striking up toward the *Pleiades* or seven stars, and seeming almost to touch them. It is to be observed any clear night, but is best *illuc nocte*. There is no such ray to be observed at any other time of the year (that I can perceive), nor any other ray at that time to be perceived darting up elsewhere. And I believe it hath been and will be constantly visible at that time of the year. But what the cause of it in nature should be, I can not yet imagine, but leave it for further inquiry."

The Importance of Public Baths.—Some interesting statistics are given by Walter Channing regarding the municipal public baths of Brookline, Mass. The baths were opened in January, 1897, and at the time Mr. Channing's article was written, about the middle of May, there had used the baths 17,089 bathers, or an average of 451 daily. A somewhat curious difference was noted between the number of males and females. The bathers during the last six weeks, for instance, being divided as follows: Men and

boys, 8,813; women and girls, only 1,080. When the baths were first opened the policy was to have as many free days as possible, but it was found quite impossible to keep order even with the aid of a police officer. Under a new arrangement by which a fee of five cents was charged, which included soap, towels, and bathing dress, a great improvement was manifested, even this small fee seeming to make the bathers more self-respecting and conscientious and doing away with that irresponsible and reckless feeling which an unadulterated charity seems so prone to produce. Instead of the fees decreasing the number of bathers, there was a constant and steady increase. An interesting experiment in connection with these baths is the giving of instruction in swimming to the public-school children. The town pays for this through the school committee. The pupils as well as the teachers have taken great interest, and already large numbers have been taught how to swim. At the end of the school year there will be thorough tests, and certificates of proficiency will be given. Aside from the value which this bath has as a swimming school and healthy recreation ground for the children, its successful continuance can not fail to have a most beneficial effect on the general personal cleanliness and sanitation of the town, a clean individual being much less patient with nasty streets and houses and neighbors, than a dirty one. The importance of the public bath does not seem to be generally appreciated in this country. It is when properly handled one of the most powerful and far reaching of the municipalities' institutions for promoting cleanliness, both mental and physical, and good citizenship; in several of the European states where this fact has been appreciated the public baths of the cities and towns are among their most important institutions.

Industrial Instability in Russia.—Industrial labor in Russia, as pictured in the bulletin of the *Musée Social*, is usually unstable and can not be depended upon. In most of the shops the workmen scatter at once in the spring. The operatives who come in after the Easter vacation, which lasts several weeks, are generally new ones, who have never worked in that kind of in-

dustry, and a new apprenticeship is necessary. Hence arises an obstacle to the development of professional skill. The new hands are very awkward, and are more quickly tired than those who are accustomed to work methodically. The workman is continually changing his place, and passes from one trade to another, as he would from one place to another, becoming now a shop operative and now an agricultural laborer. As M. Anatole Leroy Beaulieu says, he is a nomad. He is not identified with his machine, does not understand it, and does not know how to bring out its latent power. Hence in many industries which have been long organized on the grand scale in the West, the Russian does better work at home in the old way than can be turned out in the factories. Besides this, the Russian working class takes to machines with a bad grace, and will not use them except under compulsion. A curious condition, resulting partly from this disposition, is that when crops are good and the demand for manufactured products is lively, the workmen abandon the shops because they can live without the labor. It is of no use to raise wages, for that offers no attraction to the peasant who has enough to live upon in his usual way. While in the West the best-fed workman is the most efficient, in Russia the one who is satisfied is the most idle. Where women are found in the shops, it is an indication of improvement and of better development and more stable conditions.

Defects of the Metric System.—An admirable summary of the arguments against the enforced adoption of the metric system of weights and measures is presented by Mr. George W. Colles, in a paper read by him before the American Society of Mechanical Engineers. Having examined what has been said in favor of the system and against it, he concludes that the claim for its scientific accuracy is not justified, none of its units being what it purports to be; that the metre, as a scientific standard, can claim no superiority over the yard, and leaves us, moreover, without that most useful of measures, the foot; that while uniformity, carried too far, is of doubtful advantage, the metric system in practice has generally served not to introduce but to destroy it, by superadd-

ing new methods without replacing old ones; that the decimal divisions, instead of being the greatest advantage of the system, are its most irreparable defect, and of whatever uniformity of division Nature and man are capable, it can never be expressed by the number ten; and that the mind can never think in decimal fractions, but invariably does think in fractions reduced to their lowest terms, so that they are as impossible to get rid of as the mind itself. The English system, the author shows, though, like all things in Nature, it bears the marks of imperfection, the decay of time, and the usages of civilizations long since passed away, yet in its essential elements embodies the wisdom and experience of ages, and is, in fact, the survival of the fittest.

English Composition "as it is Taught."

—An idea of the value of instruction in English writing given in our common and preparatory schools may be gained from the report of the Committee on Composition and Rhetoric to the Board of Overseers of Harvard University. The committee gave out as a subject to the students for voluntary composition a description of the instruction and what they thought it was worth. Thirteen hundred and eight students in the college, Scientific School, and Radcliffe College handed in papers. These are classified and compared according to the advancement of the writers in the college course. The most noticeable feature in the papers corresponding with the freshman grade, taken as a whole, is their extreme crudeness of thought and execution; and they reveal various defects in the system of instruction used in the schools from which the writers came. The papers of the next grade were better and showed benefit from instruction received in the previous course, but with evidence of the deficiency in early elementary training still apparent. The work of the writers of the junior class (average age twenty-one years) was satisfactory, but nearly all of them expressed a decided opinion that the instruction given in the preparatory schools in written English is inadequate. All but three of the seventy papers from Radcliffe College were creditable in execution; but none of them indicated any special capacity for observing, or attempted anything in pointing

out defects which might be termed a thoughtful solution of them. The papers from the Scientific School were, curiously, "noticeably inferior in nearly all respects." The papers from graduates of normal schools were likewise not what could be reasonably expected from students of such institutions. The chief value of these papers "lies in the indirect or unconscious light they throw upon a curiously heterogeneous system of almost undirected natural growth." They also reveal "what heretofore has been the great defect in the methods of instruction in written English in the common preparatory schools. It has been taught almost wholly objectively, or as an end; almost never incidentally and as a means." In the great majority of these schools "English is still taught, it would seem, not as a mother tongue, but as a foreign language." The committee believes, however, that, taken as a whole, the inferences and conclusions to be drawn from the papers "are distinctly and unmistakably encouraging, because they reveal wherein is to be found the root of the trouble, and indicate the steps now being taken to remove that trouble. It is remarked that while methods of instruction are often unsparingly criticised, schools and teachers are, as a rule, kindly spoken of.

The International Scientific Catalogue.

—The proceedings of the International Bibliographical Conference of 1896 in London concerning the International Catalogue of Scientific Literature, Dr. Cyrus Adler's summarized account of which has only recently been published, afford many points of interest. Among them was the discussion as to the definition of a contribution to science for the purpose of the catalogue. It was decided, with the help of a committee to which the conference had to refer the subject, to mean a contribution to the mathematical, physical, or natural sciences, "such as, for example, mathematics, astronomy, physics, chemistry, mineralogy, geology, botany, mathematical and physical geography, zoölogy, anatomy, physiology, general and experimental pathology, experimental psychology, and anthropology, to the exclusion of what are sometimes called the applied sciences—the limits of the several sciences to be determined hereafter." The discussion related

not so much to the subjects that should be included, as to the terms under which they should be described and classified. It was further decided, without dissent, that in judging whether a publication is to be considered a contribution to science suitable for entry in the catalogue, regard should be had to its contents, irrespective of the channel through which it is published." The importance of this rule was emphasized by several German delegates, some of whom pointed out that trade journals, and even a daily paper which was named, often contain scientific articles of great value. Those who are disposed to ridicule "newspaper science" must hereafter qualify their flings. Regard is to be had first in the catalogue to the requirements of scientific investigators; entries are to be both by subjects and by authors' names; the catalogue is to be issued by a central bureau to be located in London, with the Royal Society advising, and in English, with authors' names and titles in their own language; and to be begun January 1, 1900. The English (including American) element was influential in the conference, and none of the delegates had more force in its deliberations than the American representatives, Prof. Simon Newcomb and Dr. J. S. Billings. The American department of the catalogue will be under the direction of the Smithsonian Institution, and an appropriation of ten thousand dollars is asked from Congress to carry on the work.

A Musical Experiment.—A somewhat interesting musical experiment was recently made by Prof. E. E. Slosson, of the University of Wyoming. Twenty-two persons—seven men and fifteen women—each provided with paper and writing materials, were given a pianoforte concert, and at the expiration of each piece were requested to write down the impressions received from the music. Only one of the twenty-two was a professional musician. The pieces played were: *a*, Chopin funeral march (sonata, op. 35); *b*, S. F. Powell nocturne, Hope (op. 4, No. 1); *c*, S. F. Powell nocturne, Solitude (op. 3, No. 2); *d*, Handel's aria, He was Despised and Rejected of Men (The Messiah); *e*, Chopin nocturne (op. 15); and *f*, Schubert, Liszt Serenade. The conclusions drawn, from an examination of the answers returned, seemed

to show that music has a somewhat definite emotional content, and that impression of this is received by the average listener, but with varying intensity. The formal content seems to be furnished entirely by the mood, associations, or temperament of the individual. A great difference exists both in the capacity of individuals to receive definite impressions and of composers to convey them. To overcome a strong individual mood requires music of extremely strong expressiveness.

Ice Caves.—Three principal forms in which ice enduring all the year round is found are mentioned by Mr. Edwin Swift Balch in his paper on Ice Caves and the Causes of Subterranean Ice: glaciers, ice gorges, and ice caves. Glaciers are formed from the winter snows, which by their own weight, and melting and regelation, have accumulated into a mass of ice. Ice gorges or gullies occur in fissures or ravines, at an altitude greatly below the general snow line of the district, where the winter snow is sufficiently protected from the sun to endure as snow or ice through the summer months. The author has, for instance, found lumps of ice in King's Ravine, on Mount Adams, in the White Mountains, among the big boulders, late in September. The ice in such gullies is formed in the same manner as that of glaciers, or that on ponds and rivers, by the cold of winter and the melting of the snows. Ice caves are roofed, and the ice is formed directly within them, and is not, except perhaps near the entrance, solidified snow. The roof, while not admitting the winter snow, is a protection against warm summer rains, and cuts off radiation—acting as a protector against heat, and tempering the cold. The caves vary greatly in their positions, shapes, and sizes. They are found in various parts of Europe, Asia, and America, mostly in the smaller ranges or in the outliers of the snowy ranges, generally in limestone and occasionally in basaltic formations. Many are found in the Jura, a few in Switzerland, a few in the Italian Alps, a number in the eastern Alps; there are some in Hungary, several in Russia, one on the Peak of Teneriffe, several in Siberia, one in Kunduz in central Asia, one in Japan, and one in Korea. Twenty-nine places are mentioned

where subterranean ice occurs in North America, two of which are in Pennsylvania. The dimensions of the caves vary greatly, some being great halls, three hundred or four hundred feet long, and some small tunnels in which one can not stand up straight. The forms assumed by underground ice are different from those visible in glaciers or icebergs. There are no *séracs* or crevasses, but stalactite forms are very common. The ice in the bottoms follows the shape of the floor. Sometimes ice is found in them of the peculiar structure called prismatic—breaking into regular prisms. Holes or runnels are formed in the lowest parts of the ice floors, where they are cut out by the melting water; and lakes and pools sometimes occur in them.

Scientific Palmistry.—The character and direction of the movements of the digits both in hand and foot, Sir William Turner observed in his anthropological address at the British Association, are imprinted on the integument of palm and sole. In the palm of the human hand the oblique direction of the movement of the fingers toward the thumb, when bent in grasping an object, is shown in the obliquity of the two great grooves which cross the palm from the root of the index to the root of the little finger. The deep curved groove, extending to the wrist, which marks off the eminence of the ball of the thumb from the rest of the palm, is associated with the opponent action of the thumb, which is so marked in man that the tip of the thumb can be brought in contact with a large part of the palmar surface of the hand and fingers. Faint longitudinal grooves in the palm, situated in a line with the fingers, express slight folds which indicate where the fingers are approximated to or separated from one another in adduction and abduction. In some hands a longitudinal groove marks off the muscles of the ball of the little finger from the rest of the palm, and is associated with a slight opponent action of that digit, by the combination of which with a partial opposition of the thumb the hand can be hollowed into a cup—the drinking cup of Diogenes. These grooves are present in the infant's hands at the time of birth, and the author has seen them in an embryo. They appear in the palm months before the infant can put its

hand to any use. They are not, therefore, acquired after birth. Grooves are also seen in the palm of the hand of the anthropoid apes, differing in various respects from those of man, and respectively characteristic of the group in which they are found.

The Psychology of Humor.—A recent number of the *American Journal of Psychology* contains an inquiry into the psychology of "tickling laughter and the comic," by Prof. G. Stanley Hall and Arthur Allin. Their material was obtained by means of a widely circulated syllabus, sent with the request that the questions be answered, and the sheet then returned to the authors. About seven hundred answers were received, many of these from school teachers having the supervision of a number of pupils, so that the real number of individuals heard from amounted to probably three thousand. The authors discuss the answers received, and then go on to a consideration of the general subject. The many theories since Aristotle, concerning wit and humor, are shown to be either purely speculative or extremely circumscribed in the range of their induction and hence furnishing no foothold for further research. Among the older conceptions of the essentials of humor mentioned is Hobbes's: "The passion of laughter is the sudden glory arising from some sudden conception of some eminence in ourselves, by comparison with the inferiority of others, or with our own formerly." Dryden defined wit as a "propriety of thoughts and words, or thoughts and words elegantly adapted to the subject." Dr. Johnson thought it "a combination of dissimilar images or discovery of occult resemblances in things apparently unlike. Richard Blackstone conceived it as "a series of high and exalted ferments." Kant defines laughter "as an affection arising from the sudden transformation of a strained expectation into nothing." Mr. J. L. Ford says: "Careful study of the work turned out by professional joke makers reveals the fact that fully nine tenths of their humor is founded on the simple idea of disaster or misfortune. . . . For a great many years nearly all our national humor had for its foundations the mother-in-law, the goat, the stove-pipe inebrity, and the banana peel." The authors

find as a result of their inquiry that all current theories are speculative and inadequate; they offer several good suggestions for a further study of the subject, two of which are the use of the camera and phonograph as automatic registers. The most important result of the inquiry seems to be the setting forth of how little we know about this department of mental phenomena.

The Blue Jay's Food.—A recent inquiry by F. E. L. Beal, assistant of the United States Department of Agriculture, into the food of the blue jay resulted in some unexpected results. The bird is distributed over the whole of the United States east of the great plains, and has a bad reputation, being charged not only with habitually robbing the nests of smaller birds of their eggs and young, but also with being very destructive to the farmer's grain. Mr. Beal examined two hundred and ninety-two stomachs in all. The remains of a small bird were found in two of these and portions of eggshells in three. He found that vegetable stuff made up three quarters of the blue jay's food, a good share of which is nuts and mast and wild berries. Their insect food makes up

about twenty-three per cent of the whole, and consists largely of noxious and destructive sorts. He concludes as follows: "The most striking point in the study of the food of the blue jay is the discrepancy between the testimony of field observers concerning the bird's nest-robbing proclivities and the results of stomach examinations. The accusations of eating eggs and young birds are certainly not sustained, and it is futile to attempt to reconcile the conflicting statements on this point, which must be left until more accurate observations have been made. In destroying insects the jay undoubtedly does much good. Most of the predaceous beetles which it eats do not feed on other insects to any great extent. On the other hand, it destroys some grasshoppers and caterpillars and many noxious beetles, such as scarabæids, click beetles, weevils, buprestids, chrysomelids, and tenebrionids. The blue jay gathers its fruit from Nature's orchard and vineyard, not from man's. Corn is the only vegetable food for which the farmer suffers any loss, and here the damage is small. In fact, the examination of nearly three hundred stomachs shows that the blue jay certainly does far more good than harm."

MINOR PARAGRAPHS.

As the result of some recently conducted experiments on feeding hogs, it is announced by the Cornell University experiment station that fully twenty-five per cent of the diseases which are supposed by the farmer to be hog cholera, or some other of the infectious diseases which attack hogs, are simply due to unhealthy food or foul surroundings. It was found, among other things, that the dishwater from hotels (which forms the basis of the ordinary swill fed about towns) was especially injurious when any of the powdered soaps had been used for dishwashing purposes, and a large number of deaths among several herds were traced to this cause. The amount of free alkali, over fifty per cent, which is present in these soap powders in the shape of sodium carbonate (ordinary washing soda) was found to be the dangerous substance.

Is it possible, asks a writer in the *Revue Scientifique*, "to affirm positively that any particular medicine is injurious or any treat-

ment bad? Assuredly not; what we condemn to-day will be good to-morrow. Did not the Sorbonne condemn quinine, tartar emetic, and antimony as injurious medicines? It was the same with transfusion. Science is revolutionized every moment by new discoveries. A doctor practicing laparotomy thirty years ago as it is practiced now would have been regarded as guilty of imprudence; yet the operation is very easily performed, perhaps too readily. There was a time when to give more than a gramme and a half or two grammes of iodide of potassium would have been a great fault; now, eighteen and even twenty grammes are given. Twenty-five years ago some doctors and even academicians denied that smallpox was contagious."

DR. BRINTON, in a recent number of *Science*, calls attention to a paper by the Marquis de Nadaillac on The End of the Human Race, and comments as follows: "Making anew the calculation of the increase of population as compared with the increase

of food supply, he reaches the gloomy conclusion that in a few centuries there will inevitably be too little food to supply all the mouths. Russia alone, at its present rate of births, will in one hundred years be obliged to feed eight hundred million persons. What, he asks, can stem this overwhelming tide of population? He gives up the problem, and says we must leave it to God, a solution which is more creditable to his piety than to his position as a scientist. The real solution is to educate men and women to the point where they will not recklessly produce offspring, nor yet ruthlessly prevent them, as is the case now in some departments of France. Unfortunately, prejudice stands in the way of a fair and free discussion of this solution."

LIKE our bison and the giraffe, the African wildebeest, or white-tailed gnu, is at the point of extinction. It is computed, the London Spectator says, that there are only about five hundred and fifty of these animals surviving in a wild condition, though they were at no great distance of time numbered by tens of thousands. Four herds are mentioned as still surviving in the Orange Free State, three of about one hundred each, which are fenced in, and one belonging to a wealthy Boer farmer, Mr. Plet Terblans, consisting of some two hundred and fifty animals, running perfectly wild, but protected on his wide domain by the vigilance of his sons and black servants. Having found the dead bodies of twenty-seven of these animals, all shot at one drinking place on the same day, from only one of which the skin and meat had been taken, he determined to stop the slaughter and did it. His farm is thirty square miles in area, and the wildebeests seem to be aware that they are exposed to danger elsewhere. They will go twenty miles in a night to feed upon some particularly good grass on other land, but gallop back to sanctuary at sunrise.

NOTES.

THE Report of the New York or American Section of the Society of Chemical Industry for 1896-'97, Dr. H. Schneitzer, New York, local secretary, speaks of the continued growth and prosperity which the section, as well as the society at large, enjoyed during the year. Seventy-nine members were added to the New York section, and the number of

members residing in America is now four hundred and seventy-one. Seven general meetings were held during the session representing the year, at which, besides the opening address of Chairman C. F. Chandler, twenty-four papers were read, most of which have been published in the Journal of the Society in London. The society is regarded by its promoters as a necessary addition to the existing Chemical Society, its aims being the promotion of the industrial and manufacturing branches of chemistry.

THE British Association at its recent meeting made appropriations for grants for scientific purposes amounting to £1,350. The sum was larger than had been voted for several years, because the committee desired to make some grants for the pursuit of local investigations, to be expended by the various committees which had been appointed for the purpose of study and research in Canada. These committees relate to the establishment of a meteorological observatory on Montreal Mountain, Canadian photographs of geological interest, the biology of the lakes of Ontario, the industrial and social conditions of the northwestern Indian tribes, the organization of an ethnological survey of Canada, and the establishment of a biological station in the Gulf of St. Lawrence.

PROFESSOR LEONARD has recently shown that cathode rays in air form regions of mist condensation. A jet of steam, a short distance from the aluminum window of a Crookes tube, becomes of a bright whiteness and of a cloudy nature. The cathode rays seem to act far more powerfully than the X rays in this way. A. Paulsen has formed a cathode-ray theory of the northern lights.

THE scientific value of Prof. O. C. Marsh's collections just presented to Yale University can not be overestimated. Perhaps the most important of these is the collection of vertebrate fossils, which contains the famous series illustrating the genealogy of the horse. The only conditions attached to the gift are those necessary to insure the permanent care and preservation of the collections themselves.

THE Franklin Institute of Philadelphia is making part of its building fireproof, for the safer storage of its valuable library. In connection with the change a much larger space will be provided for the reading room and for the display of models and apparatus and for general museum purposes.

BLEEDING has long been discarded by the doctors, but if the experiments of the Russian physiologist Essipor have any significance there may be some virtue in it, after all. This gentleman has found that an abundant drawing of the blood has important effects on the chemical composition and properties of what is left. After drawing large quantities of blood, amounting to as much as

one fortieth the weight of the body, from rabbits, guinea-pigs, and pigeons, Mr. Essipor affirms that the fluid acquired a marked bactericidal power, particularly against the microbe of cholera. The effect took place gradually, and attained its maximum in about twenty-four hours. At the same time the animal became refractory against inoculations.

EDWARD GERMANO recently conducted a series of experiments to determine the time which the typhoid bacillus could retain its vitality under various conditions. The results showed that in dry air the cultures were dead within twenty-four hours, but in moist warm air they retained their vitality for sixty days. He concludes that aerial transmission in the ordinary acceptation of the term—that is, being blown about as dust or as a miasm in the wind from infected districts—is highly improbable; but that in imperfectly disinfected and apparently dry blankets and woolen clothing the microbes may retain their vitality for some time and be conveyed long distances.

SOME recent experiments by Professor Oliver and Dr. Bolam on the immediate cause of death by electric shocks seem to indicate that death is due to a sudden arrest of the heart's action and that simultaneous failure of the respiratory center and the heart, except with unusually high voltage, is very rare. It follows from this that resuscitation in apparent death from electric shock is made much more difficult than if the fatal result were brought about by respiratory failure.

THE oldest oak tree in France, the St. Bernard oak at Cunfin, is more than eight hundred and twenty-five years old, having been planted in A. D. 1070, and is mentioned in the *Annales ecclésiastiques du Diocèse de Langres*. It measures twenty-two feet in circumference at the collar of the roots, and is forty-two and a half feet high to the first branches. The trunk is hollow, and the wood has nearly all disappeared, leaving little else than the bark, which, too, has been eaten away in spots; one of the holes is large enough to let a man inside. A niche was made in the upper part of the trunk by the curé of Cunfin in 1749, and the statue of the Virgin was placed in it. That was swept away during the Revolution, but the old tree still lives.

A BLUFF of clay marl capped with yellow gravel, fronting Raritan Bay, near Cliffwood, N. J., the extreme northeastern exposure of the cretaceous clay and marl outcrop of the State, is a source from which collections of the fauna have been made, and the only spot where the flora of the horizon has been observed. It has been explored geologically by Messrs. Arthur Hollick, Lester F. Ward, and N. L. Britton, who have collected con-

siderable material from it. The specimens, as a whole, are not very satisfactory, consisting of poorly preserved mollusks, fragments of crustaceans, fruit, leaves and branches of trees, and masses of lignite, many of them occurring in ferruginous concretions which soon disintegrate on exposure to the air. Mr. Hollick, in his paper describing and figuring them, notices twenty-six species of plant remains, ten of which are apparently new.

THE result of a careful study of four hundred alcoholies by Forel, of Zurich, again emphasizes the great importance of heredity. Forty-three per cent of the cases had one or both parents alcoholic. Fifteen per cent of the patients were wholesale or retail liquor dealers. All cases showed various physical, mental, and moral alterations. Fourteen per cent were epileptics.

A COMPARISON of the fossil foraminifera of the marine clays of Maine is adduced by Mr. F. S. Morton, in a communication to the Portland Society of Natural History, as furnishing additional evidence that the climate when they were deposited was very much colder than now. Many of the forms are still found living in the Gulf of St. Lawrence, but the forms found still farther north more perfectly agree with them. Those found by the late H. B. Brady in the shallow-water dredgings from the Novaya Zemlya Sea are almost identical with the Maine fossil forms.

DR. DAWSON WILLIAMS, who has been connected with the editorial staff of the British Medical Journal for seventeen years as assistant editor under Mr. Ernest Hart, has been appointed editor-in-chief to succeed the latter.

IN the list of recent deaths of men associated with science are recorded the names of Arthur Kammernann, astronomer, at Geneva, Switzerland, December 15th, aged thirty-six years; Prof. Knud Styffe, director of the School of Technology at Stockholm, a great authority on iron and steel and author of a report on The Elasticity, Extensibility, and Tensile Strength of Iron, which has been translated into English, February 3d, in his seventy-fifth year; Jean Albert Gauthier Villars, printer to the French Academy of Sciences, and publisher of the works of Lagrange, Fermat, Fourier, Cauchy, and other scientific investigators, February 5th, at the age of sixty-nine years; Dr. Rudolf Leuckart, professor of zoölogy and zoöatomy at Leipzig, February 7th, aged seventy-four years; and John Carrick Moore, an eminent geologist in the earlier part of the century, author of papers on Silurian strata, Tertiary fossils of Santo Domingo and Jamaica, Erosion of Lake Basins, and the Influence of the Obliquity of the Ecliptic on Climate; in London, February 10th, in his ninety-fifth year—a nephew of Sir John Moore.



11 8 '98

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